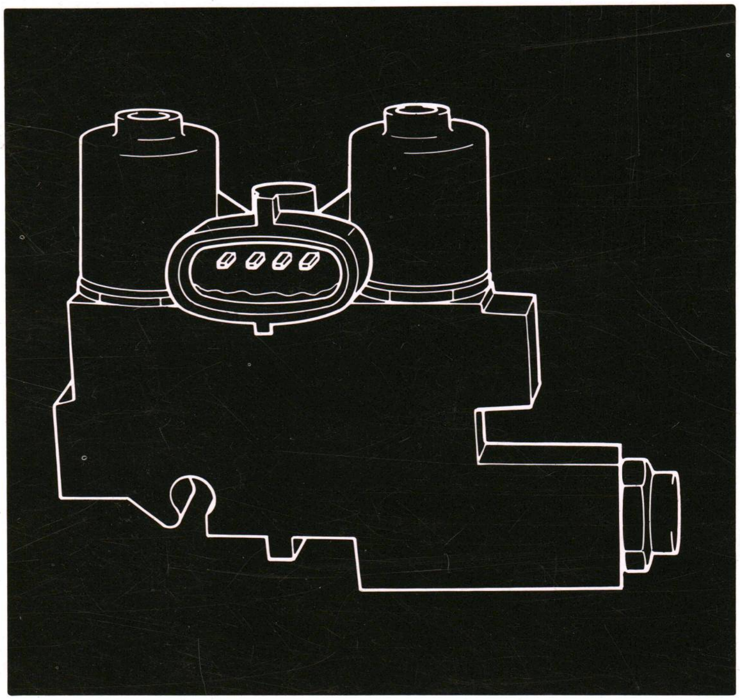
# Light Truck Rear Antilock Braking Systems



Ford Parts and Service Division
Technical Training

# IMPORTANT SAFETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Be sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific service operation. If you have a manual transmission, it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific service operation.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide.
- Keep yourself and your clothing away from moving parts when the engine is running, especially the fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on the vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle. Tie long hair securely behind your head.
- Keep hands and other objects clear of the radiator fan blades. Electric cooling fans can start to operate at any time by an increase in underhood temperatures, even though the ignition is in the OFF position. Therefore, care should be taken to ensure that the electric cooling fan is completely disconnected when working under the hood.

The recommendations and suggestions contained in this manual are made to assist the dealer in improving his dealership parts and/or service department operations. These recommendations and suggestions do not supersede or override the provisions of the Warranty and Policy Manual or the Shop Manual and in any cases where there may be a conflict, the provisions of the Warranty and Policy Manual or the Shop Manual shall govern.

The descriptions, testing procedures, and specifications in this handbook were in effect at the time the handbook was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications, design, or testing procedures without notice and without incurring obligation. Any reference to brand names in this manual is intended merely as an example of the types of tools, lubricants, materials, etc. recommended for use. Equivalents, if available, may be used. The right is reserved to make changes at any time without notice.

**WARNING:** Many brake linings contain asbestos fibers. When working on brake components, avoid breathing the dust. Breathing the asbestos dust can cause asbestosis and cancer.

Breathing asbestos dust is harmful to your health.

Dust and dirt present on car wheel brake and clutch assemblies may contain asbestos fibers that are hazardous to your health when made airborne by cleaning with compressed air or by dry brushing.

Wheel brake assemblies and clutch facings should be cleaned using a vacuum cleaner recommended for use with asbestos fibers. Dust and dirt should be disposed of in a manner that prevents dust exposure, such as sealed bags. The bag must be labeled per OSHA instructions and the trash hauler notified as to the contents of the bag.

If a vacuum bag suitable for asbestos is not available, cleaning should be done wet. If dust generation is still possible, technicians should wear government approved toxic dust purifying respirators.

OSHA requires areas where asbestos dust generation is possible to be isolated and posted with warning signs. Only technicians concerned with performing brake or clutch service should be present in the area.

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**Earl Petersen**
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**Ford Parts and Service Division**

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# INTRODUCTION

This reference book is designed to familiarize you with the operation and testing of the Rear Antilock Brake System (RABS) used on light trucks. This reference book should help you understand the need for antilock brake systems and reinforce some of the concepts that involve brake systems in general. On all vehicles, there are several factors that come into play when the brakes are applied. Brake balance and brake proportioning help to distribute the braking force.

## BRAKE BALANCE

The weight of a vehicle is distributed unevenly between the front and rear axles. All vehicles are designed with more of their weight toward the front to improve vehicle handling and road holding characteristics. During braking, additional weight shifts forward increasing the load on the front brakes. Because of this, more braking force needs to be applied to the front wheels than the rear wheels.

## BRAKE PROPORTIONING

Braking force is proportioned two ways. The first is to use larger disc brakes on the front wheels and either disc or drum brakes on the rear wheels. Because disc brakes can be designed to provide greater braking force than drum brakes, the use of front disc brakes allows for an increase in braking at the front wheels.

Another way of distributing braking force is the use of proportioning and metering valves (Figure 1). When the brake pedal is applied, brake fluid passes through the proportioning valve to the front and rear brake system. When the hydraulic pressure reaches a set point, the proportioning valve begins to regulate the pressure. It limits brake line pressure to the rear brakes to help create a balanced braking condition.

The metering valve keeps the front brakes from being applied until the rear brakes have started to work. When the brake pedal is applied, full

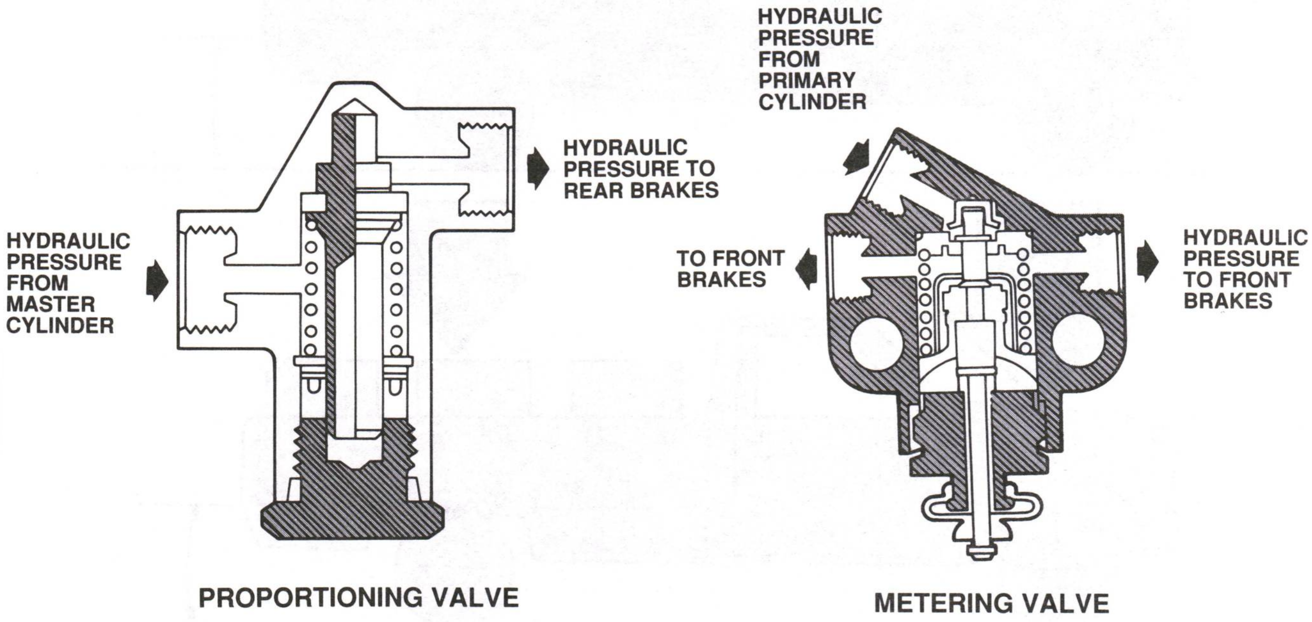

HYDRAULIC PRESSURE FROM MASTER CYLINDER
HYDRAULIC PRESSURE TO REAR BRAKES
PROPORTIONING VALVE
HYDRAULIC PRESSURE FROM PRIMARY CYLINDER
TO FRONT BRAKES
HYDRAULIC PRESSURE TO FRONT BRAKES
METERING VALVE

Figure 1 – Proportioning and Metering Valves

pressure is immediately applied to the rear brakes. The amount of pressure that is sent to the front brakes is limited. When the brake pedal is further applied, master cylinder pressure builds. When a set pressure is reached in the master cylinder, the metering valve opens to allow full pressure to be applied to the front brakes.

## SPECIAL NEEDS OF LIGHT TRUCKS

The braking needs of light trucks are different from those of other vehicles because of design differences. A light truck normally carries over 70 percent of its weight forward of center. This is because trucks are designed to carry a load. When the truck is loaded, the percentage of the weight it carries forward of center changes depending on the weight and distribution of the load (Figure 2). A standard proportioning valve with a predetermined set point cannot respond to the varying load demands placed on light truck brakes. In place of (or often, in addition to) standard brake valves, a special valve was designed for light truck antilock applications. This valve controls hydraulic pressure to the rear wheels based on rear antilock braking system (RABS) module signals. The RABS provides improved braking control and prevents rear wheel lockup under most operating conditions.

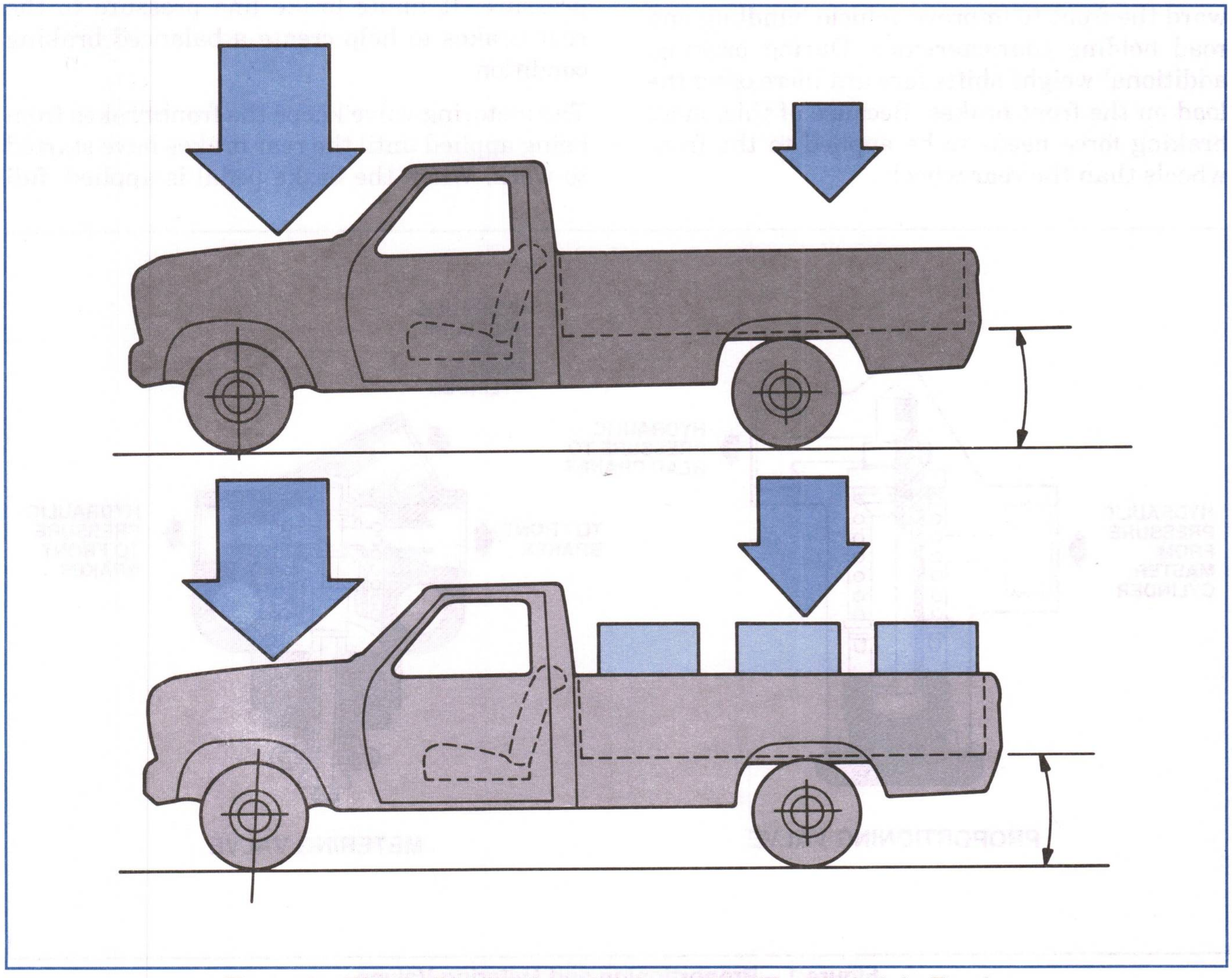


Figure 2 – Weight Distribution of Unloaded and Loaded Light Trucks

## ANTILOCK

Manufacturers developed antilock systems because brakes have the tendency to lock up under certain road conditions, such as wet pavement. When the rear wheels lock up, the vehicle may become unstable and start to slide. Because of this, controlling the lockup of the rear wheels is an important concern. The rear antilock brake system used on light trucks provides antilock control to the rear wheels to improve directional stability during lockup conditions (Figure 3).

It is still possible for vehicles equipped with RABS to experience rear brake lockup. The module uses an average of the rear wheel speeds. If one rear wheel is locked and the other is turning freely, the average of the wheel speeds may be at a rate of deceleration that the RABS module finds acceptable. Under these conditions, RABS will not activate even though one wheel is experiencing lockup.

It is also possible to "sneak" into lockup. The software in the module is designed to recognize an acceptable rate of deceleration. If the rate of deceleration never leaves the limits of what the module considers acceptable, RABS will not activate.

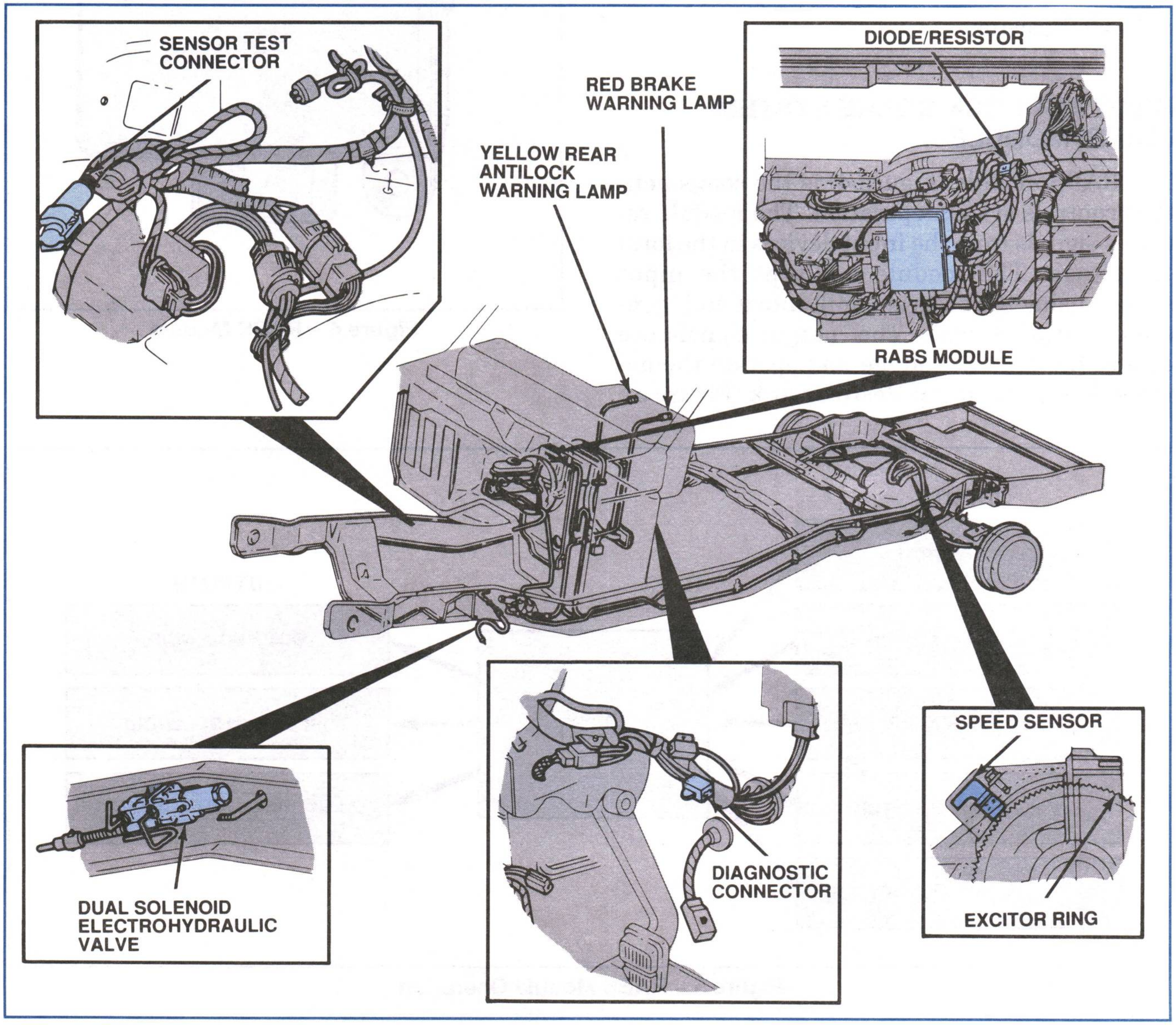


Figure 3 – Typical Location of RABS Components

# RABS COMPONENTS

The components of the RABS include:

- RABS Module
- Speed Sensor and Excitor Ring
- 4 x 4 Indicator Switch
- Brake Fluid Level Switch
- Pressure Differential Switch (Aerostar only)
- Stoplamp Switch
- RABS Valve
- REAR ANTILOCK Lamp
- Sensor Test Connector
- RABS Diagnostic Connector
- Diode/Resistor

## REAR ANTILOCK BRAKE SYSTEM (RABS) MODULE

The RABS module (Figure 4) is the component that controls system operation. The module receives signals from the input devices in the form of voltage. The module analyzes the input signals using the program built into it and generates output signals. The output signals are also in the form of voltage and operate the devices that perform the desired work (Figure 5).

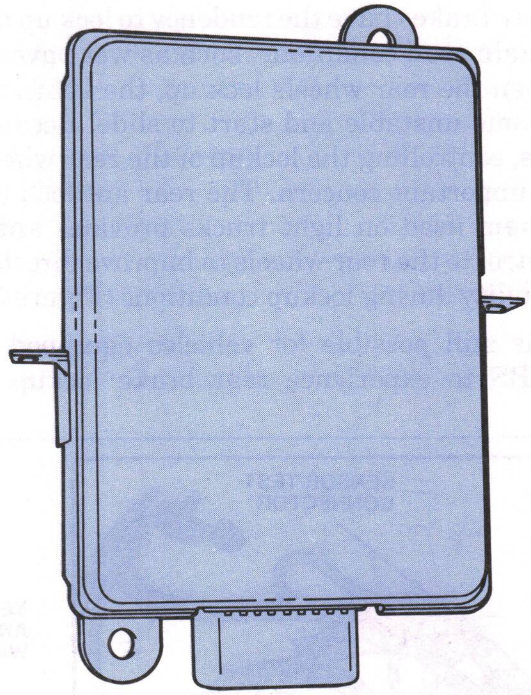


Figure 4 – RABS Module

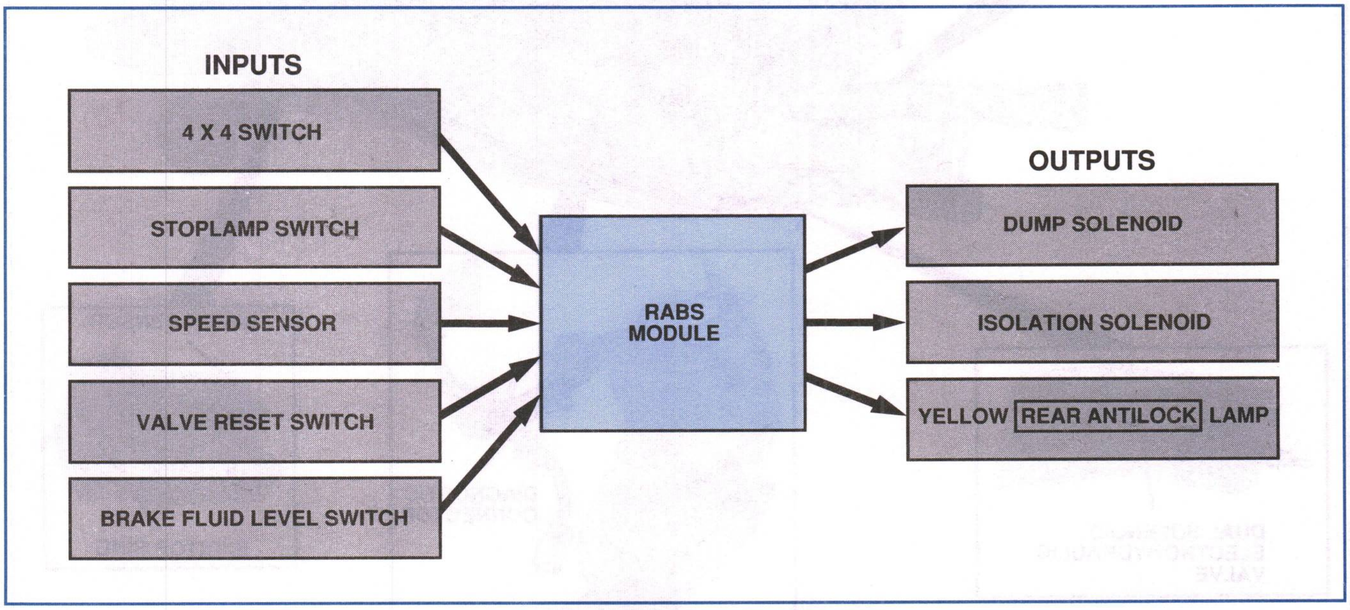


Figure 5 – RABS Module Operation

The module incorporates a self diagnostic function that allows it to monitor system operation and determine if and when a malfunction occurs. System malfunctions are commonly referred to as faults. If the module determines that a fault is present in the system, it will shut the system down and illuminate the yellow REAR ANTILOCK lamp on the instrument panel. The information regarding the fault is stored in the module's memory in the form of a code. This code is lost if the vehicle is turned off. By accessing the code, the malfunction can be diagnosed and serviced.

RABS module location varies with vehicle application (Figure 6). On the F-150, F-350 and Bronco models, the RABS module is located in the cab to the right of the brake pedal under the upper dash panel. On E-150 and E-350 models, it is located in the cab on the driver's inside cowl panel, near the parking brake mechanism (Figure 7).

| VEHICLE | LOCATION |
|---|---|
| F-150, F-350, Bronco<br>under the upper dash | In the cab, to the right of the brake pedal |
| E-150, E-350<br>near the parking brake mechanism | In the cab, on the driver's inside cowl panel |
| Explorer, Ranger, 1989 and newer Bronco II | In the cab, under the instrument panel mounted to the center panel brace |
| Pre-1989 Bronco II<br>side door pillar | Behind an access cover in back of the driver's |
| Aerostar<br>under the instrument panel | In the cab, on the driver's side of the doghouse |

**Figure 6 – RABS Module Location**

# RABS COMPONENTS

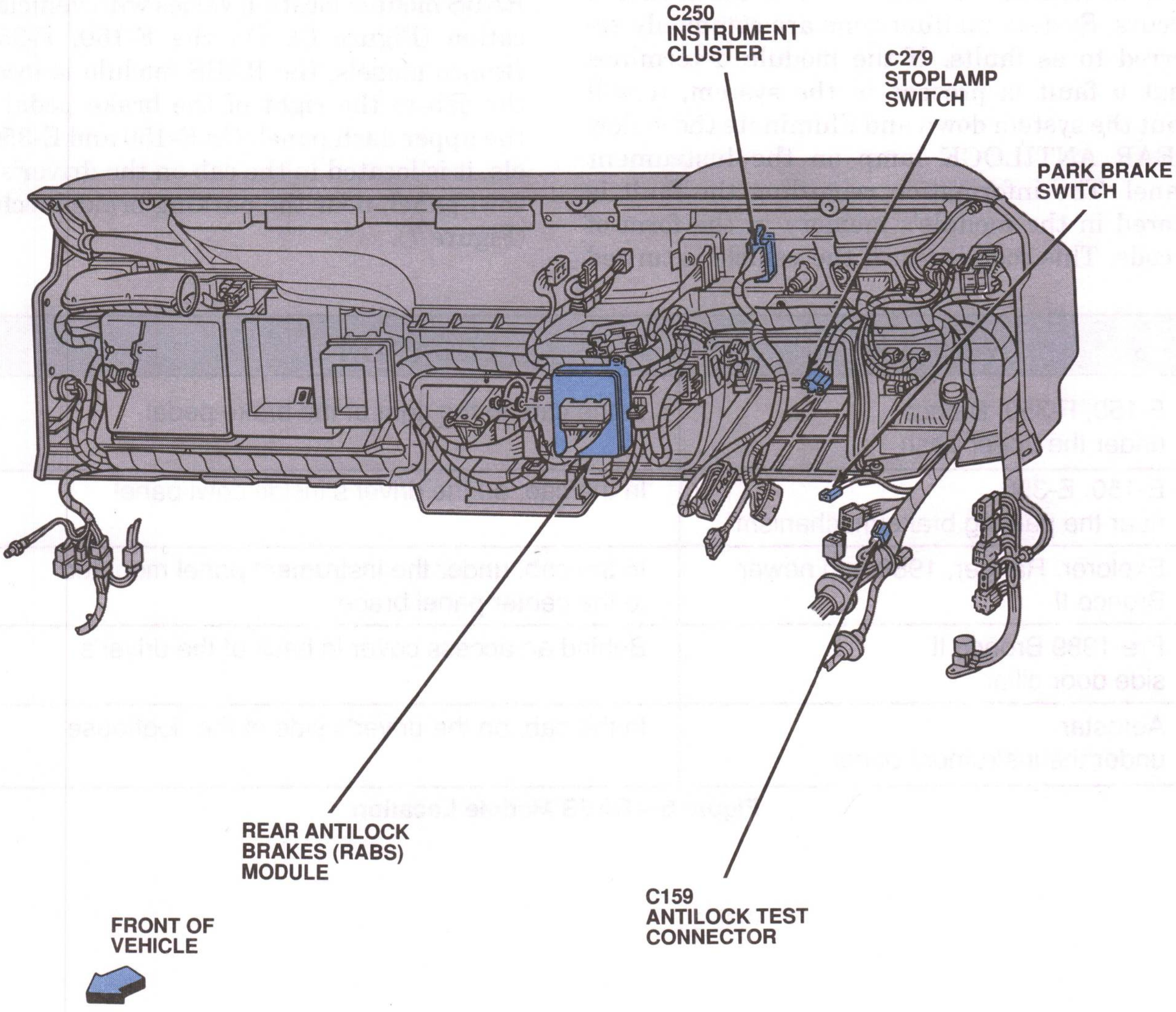


**Figure 7 – Component Location — Bronco, F-150 – F-350**

# RABS COMPONENTS

On Explorer, Ranger and 1989 and newer Bronco II vehicles, the RABS module is located under the instrument panel, mounted to a brace in the center of the panel area (Figure 8).

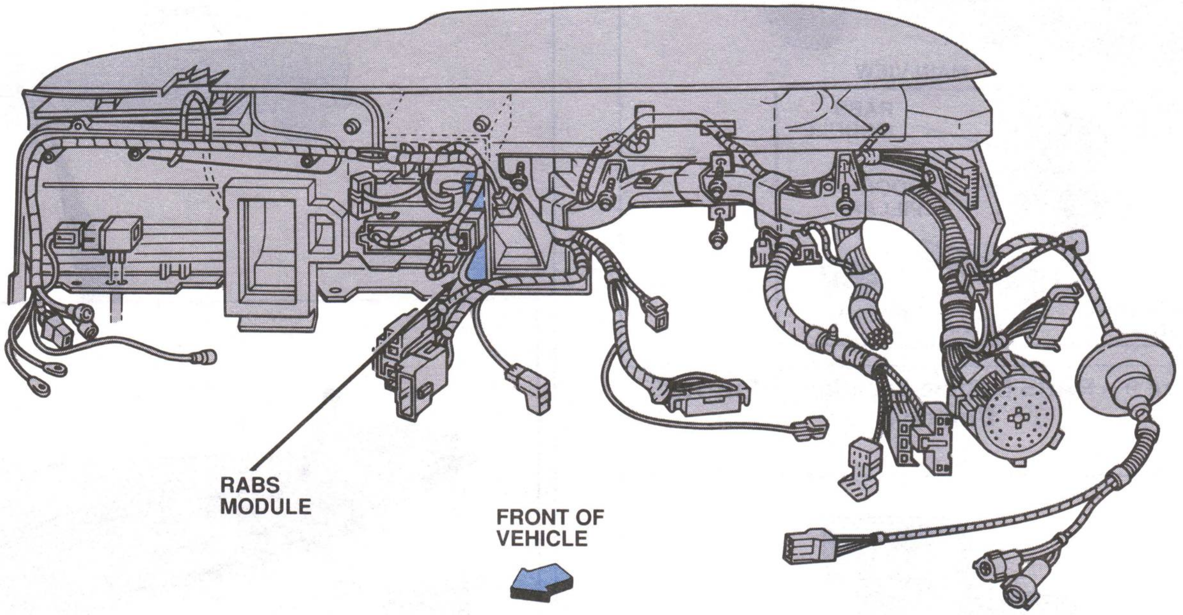


Figure 8 – RABS Module Location — Ranger, Explorer, 1989 and Newer Bronco II

# RABS COMPONENTS

On pre-1989 Bronco II vehicles, the module is located behind an access cover in back of the driver's side door pillar (Figure 9). On the Aerostar, the module is mounted to the driver's side of the doghouse, under the instrument panel.

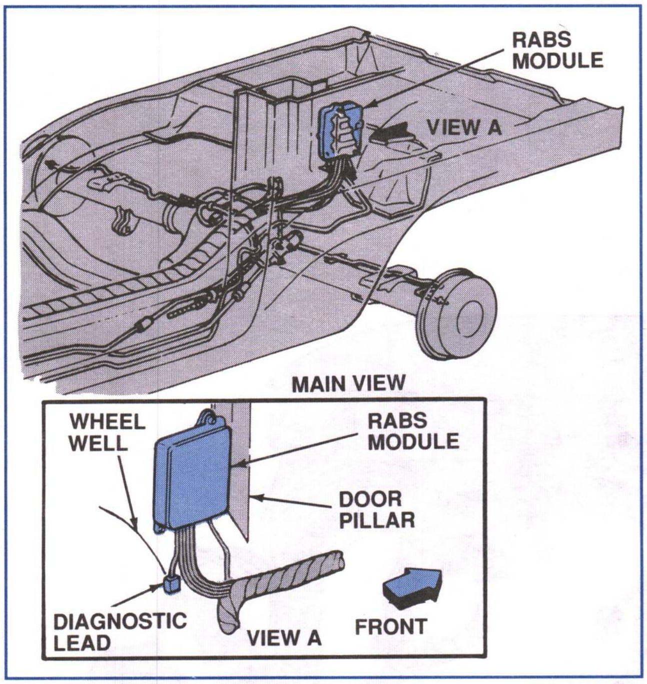


Figure 9 – RABS Module Location — Pre-1989 Bronco II

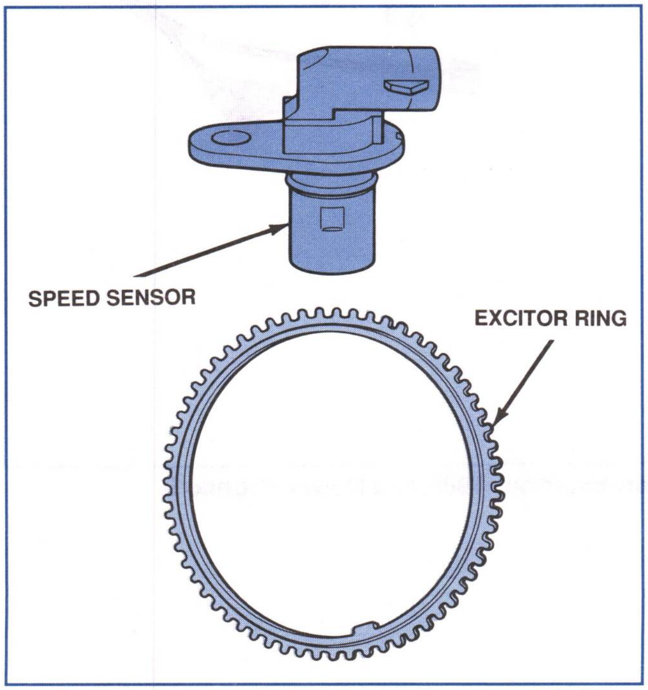


Figure 10 – Speed Sensor and Excitor Ring

## SPEED SENSOR AND EXCITOR RING

The speed sensor and excitor ring (Figure 10) work together to provide wheel speed information to the RABS module. When a tooth on the excitor ring passes by the sensor pole piece, AC voltage is induced in the sensor circuit. The frequency of this signal is proportional to the average speed of the rear wheels. Both the speed sensor and the excitor ring are located on the rear differential housing (Figure 11).

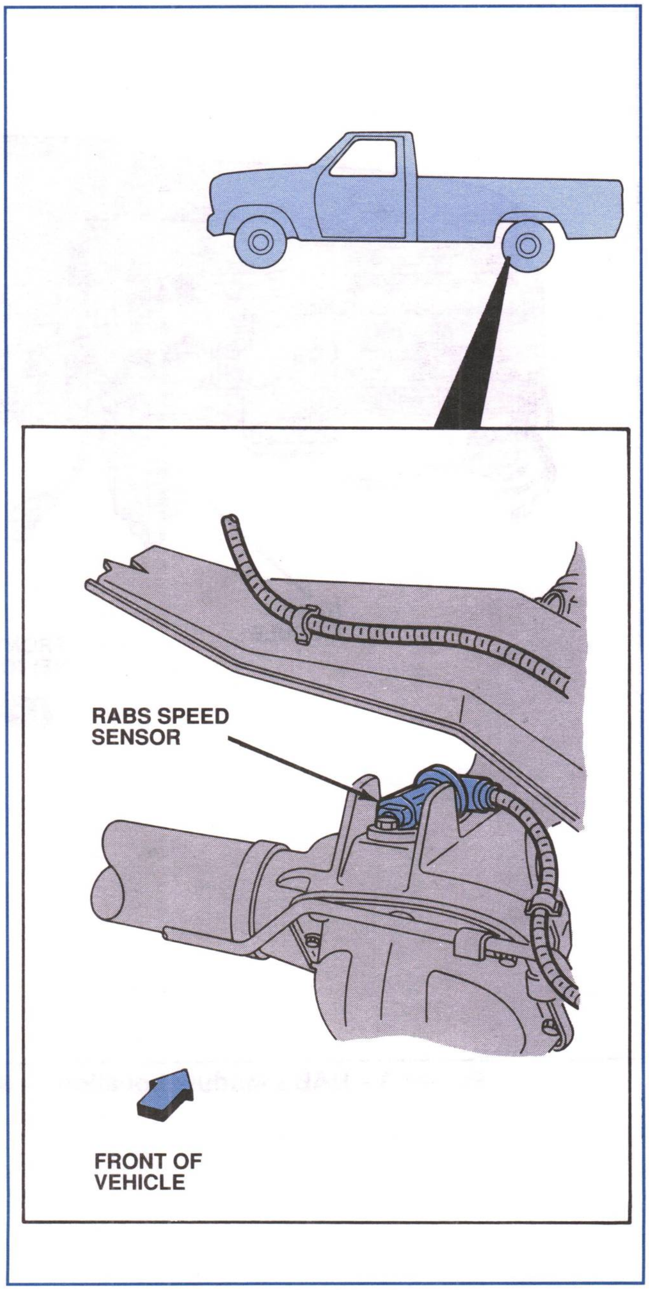


Figure 11 – Inside Rear Axle

## 4 X 4 INDICATOR SWITCH

The 4 x 4 indicator switch (Figure 12) signals the RABS module when the vehicle is in 4 x 4 operation. In 4 x 2 operation, the module records the number of times the dump solenoid has been pulsed. If it records 16 uninterrupted dumps in 4 x 2 operation, it assumes that there is a problem and deactivates RABS. In 4 x 4 operation, the module will not consider 16 uninterrupted dumps to be abnormal. The module will not allow more than 16 dumps, but will not store a fault code or deactivate the system.

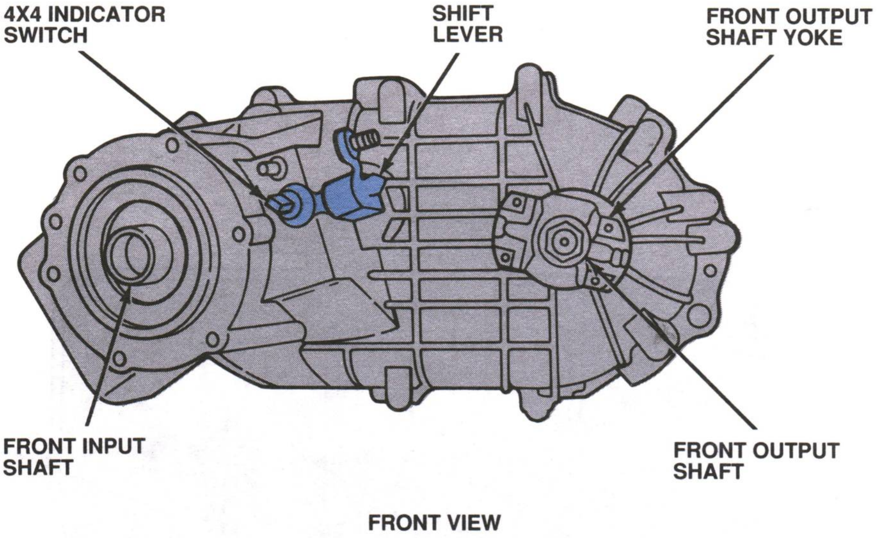


Figure 12 – 4 x 4 Indicator Switch

## BRAKE FLUID LEVEL SWITCH

The brake fluid level switch monitors the level of brake fluid in the master cylinder (Figure 13). If the fluid drops below a certain point, the switch lights the red BRAKE lamp on the instrument panel. The switch also signals the RABS module that there is a low fluid level. The module deactivates RABS and lights the yellow REAR ANTILOCK lamp.

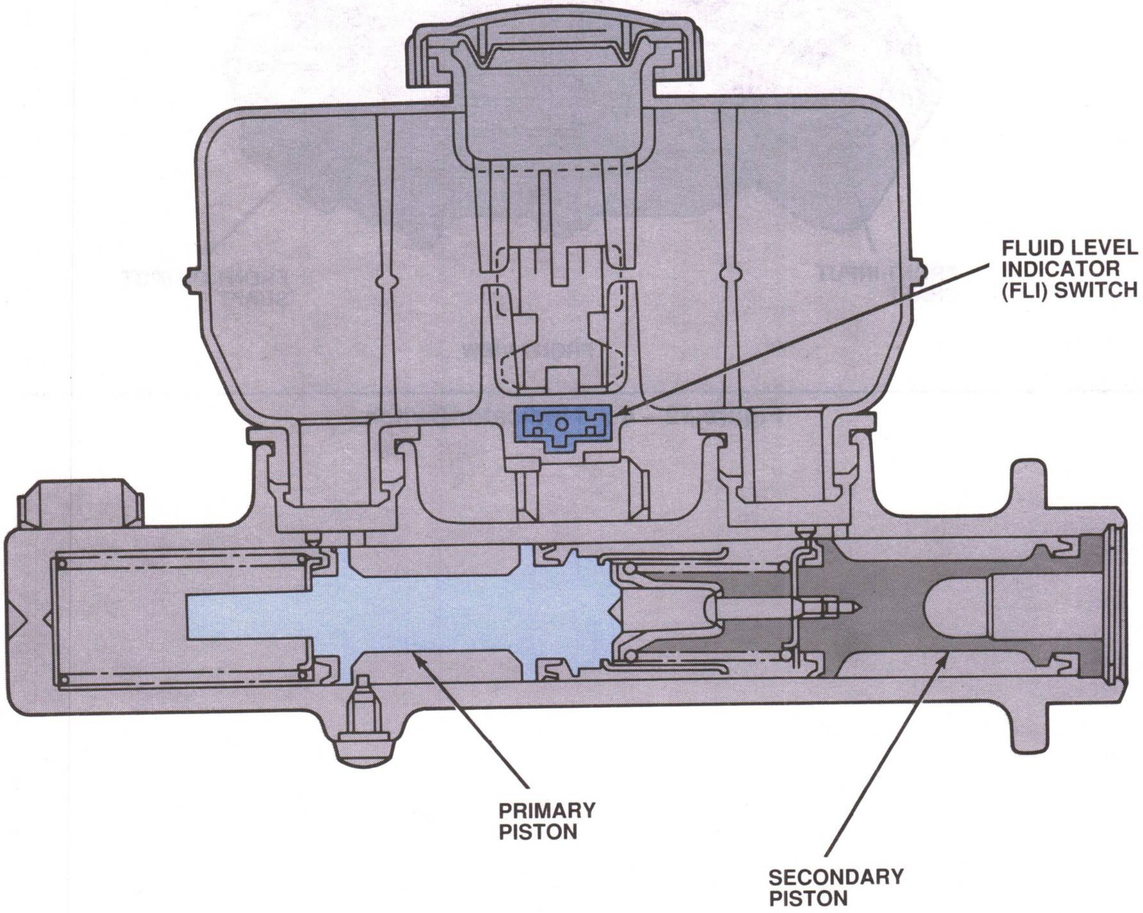


Figure 13 – Master Cylinder Assembly

## STOPLAMP SWITCH

The stoplamp switch is responsible for disabling the speed control system when the brakes are applied (Figure 14). It also operates the stoplamps when the brake pedal is depressed. The stoplamp switch signals the RABS module that the brakes have been applied. Without this signal, the RABS will not activate. With this signal, the module controls brake pressure in response to the wheel speed signal.

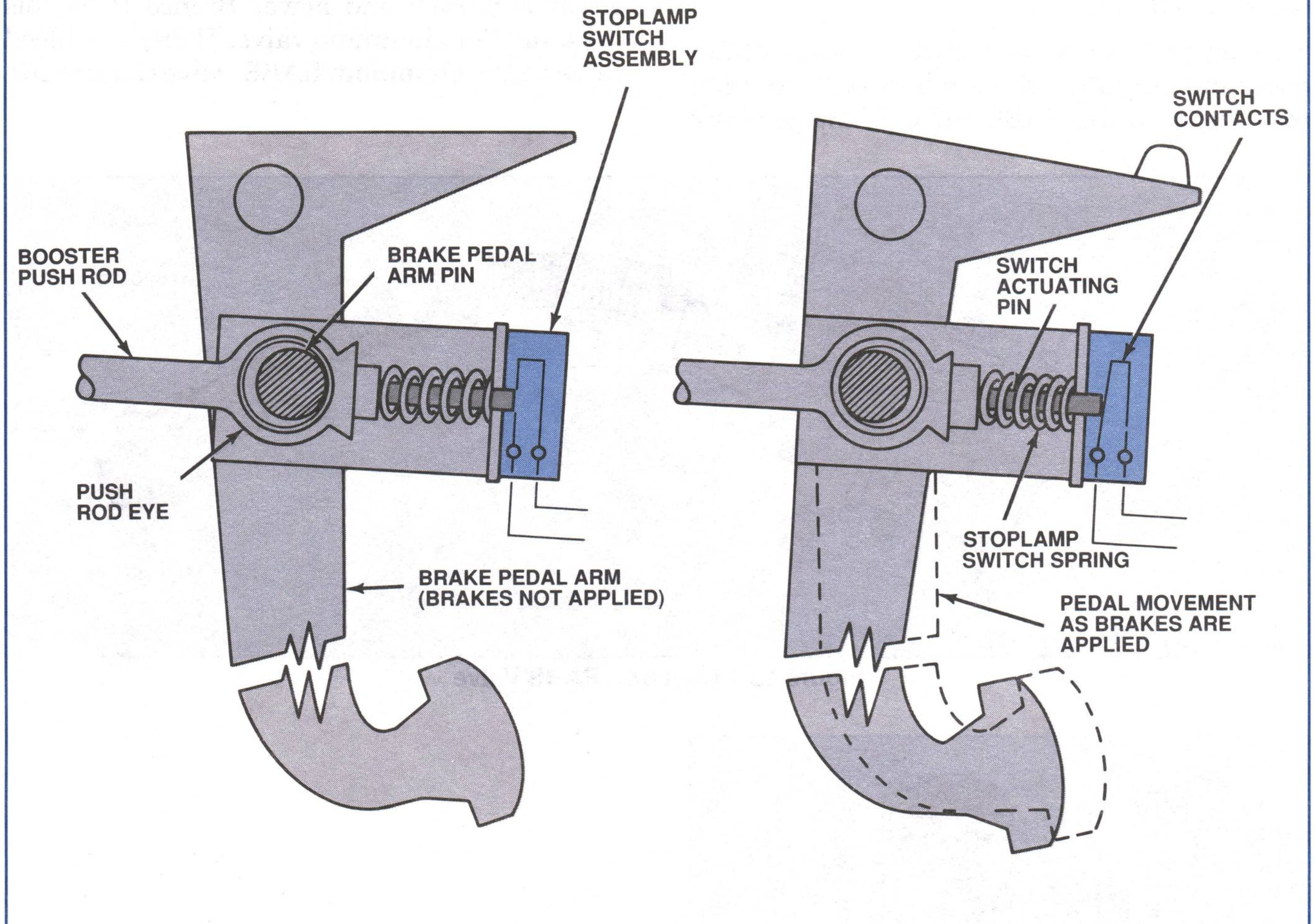


Figure 14 – Stoplamp Switch

## RABS VALVE

The RABS valve controls hydraulic pressure to the rear wheels based on the module signals. The RABS valve contains the isolation solenoid, isolation valve, dump solenoid, dump valve, fluid accumulator and valve reset switch. When the module energizes the isolation solenoid, the isolation valve closes. Current directed to the dump solenoid opens the dump valve causing fluid to bleed from the rear brake system into the accumulator.

The integral valve reset switch senses differences in hydraulic pressure between the input and output of the RABS valve. If the pressure difference between the front and rear brakes is greater than 100 psi, it alerts the RABS module. The module then energizes or de-energizes the isolation solenoid to create more balanced braking.

The system uses one of two RABS valves depending on the vehicle application. F-Series, E-Series, Bronco and pre-1989 Bronco II vehicles use a cast iron valve with an integral bleed screw (Figure 15). Aerostar, Ranger, Explorer and 1989 and newer Bronco II models use a smaller aluminum valve. There is no bleed valve on the aluminum RABS valve (Figure 16).

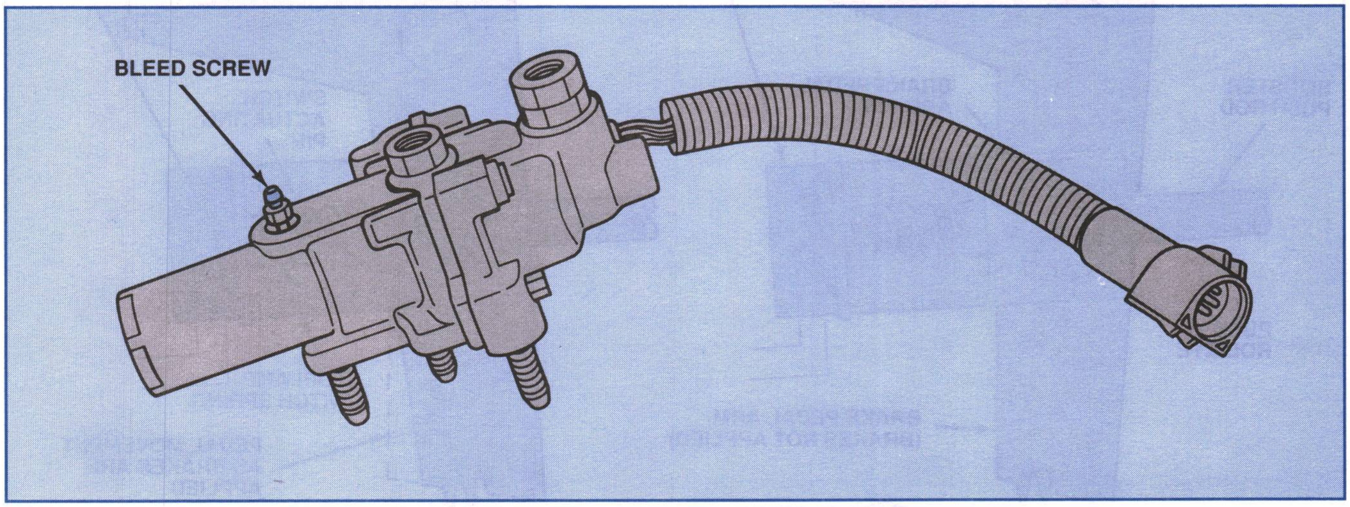


Figure 15 – Cast Iron RABS Valve

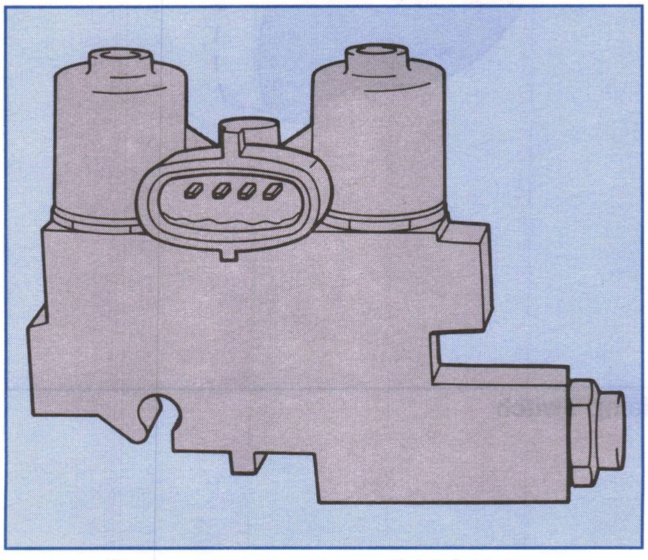


Figure 16 – Aluminum RABS Valve

The location of the RABS valve varies with vehicle application (Figure 17). On F-150, F-350 and Bronco models, the RABS valve is located on the left inside frame rail just behind the number 1 crossmember. On E-150 and E-350 models, it is located on the left inside frame rail behind the engine mount crossmember. On Explorer, Ranger and Bronco II models, the RABS valve is located on the left inside frame rail, 5 inches behind the number 1 crossmember. On the Aerostar, the RABS valve is located on the fender apron, below the master cylinder.

| VEHICLE | LOCATION |
|---|---|
| **F-150, F-350, Bronco** | On the left inside frame rail, just behind the number 1 crossmember |
| **E-150, E-350** | On the left inside frame rail, behind the engine mount crossmember |
| **Explorer, Ranger, Bronco II** | On the left inside frame rail, 5 inches behind the number 1 crossmember |
| **Aerostar** | On the fender apron, below the master cylinder |

**Figure 17 – RABS Valve Location**

## REAR ANTILOCK LAMP

The RABS module also controls the REAR ANTILOCK warning lamp on the instrument panel. This yellow lamp indicates RABS malfunction and deactivation. If the RABS module detects a fault, it deactivates the system and turns the lamp on.

## SENSOR TEST CONNECTOR

The sensor test connector (Figure 18) can be used to test speed sensor operation. On F-Series, E-Series, Bronco, Explorer and Econoline models, the sensor test connector and dust cap are located on the left fender apron. On Ranger and Bronco II models, the sensor test connector is located under the hood, slightly rearward of the washer bottle. On the Aerostar, the sensor test connector is located forward of the 53 pin connector on the left hand fender apron.

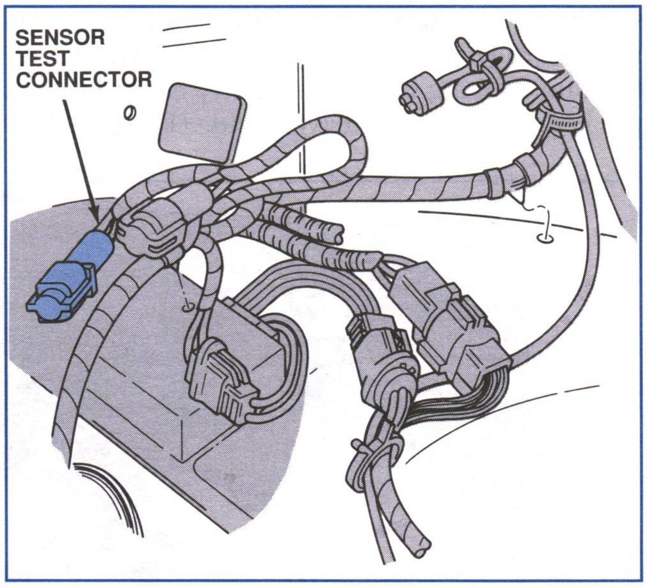


**Figure 18 – Sensor Test Connector**

## RABS DIAGNOSTIC CONNECTOR

The RABS diagnostic connector can be momentarily grounded with a jumper wire to obtain flashout codes for diagnosing the RABS.

RABS diagnostic connector location varies with vehicle application (Figure 19). On F-150, F-350 and Bronco models, the diagnostic connector is located in the cab and clipped on the main instrument panel wiring harness about 6 inches from the bulkhead near the parking brake pedal. On E-150 and E-350 models, the diagnostic connector is located near the module connector harness. On Explorer, Ranger, Aerostar and Bronco II models, the diagnostic connector is in the cab on the main wiring harness, slightly behind the 53 pin connector on the driver's side (Figure 20).

| VEHICLE | LOCATION |
|---|---|
| **F-150, F-350, Bronco** | In the cab, clipped to the main instrument panel wiring harness about 6 inches from the bulkhead near the parking brake pedal |
| **E-150, E-350** | In the cab, near the RABS module connector wiring, near the parking brake mechanism |
| **Explorer, Ranger, Aerostar, Bronco II** | In the cab, on the main wiring harness, slightly behind the 53 pin connector |

**Figure 19 – RABS Diagnostic Connector Location**

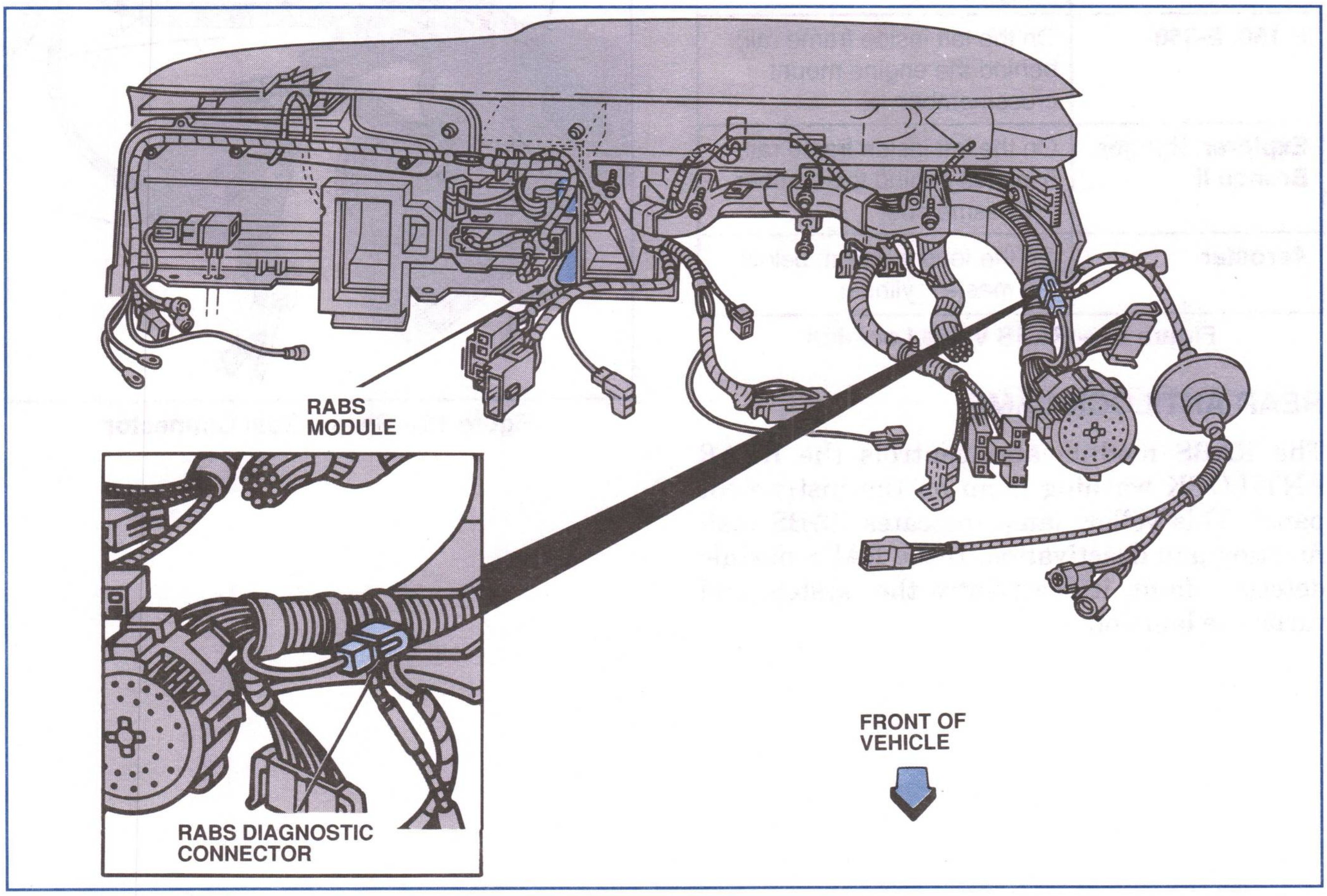


**Figure 20 – Test Connector Location — Ranger, Explorer, Aerostar, Bronco II, As Seen from Rear**

## DIODE/RESISTOR

The diode/resistor isolates the RABS module from the parking brake switch and the low vacuum switch (diesel engines). The diode/resistor prevents voltage from reaching the RABS module to stop the yellow REAR ANTILOCK lamp from lighting and the system from shutting down when the parking brake is applied or the low vacuum switch closes.

The location of the diode/resistor varies with vehicle application (Figure 21). On F-150, F-350, Bronco, E-150, and E-350 models, the diode/resistor is located on the main trunk of the instrument panel wiring harness where the RABS module connector pigtail intersects the main trunk. On Explorer, Ranger and Bronco II models the diode/resistor element is located in the master cylinder fluid level sensor wiring harness on the left fender apron. On the Aerostar, the diode/resistor is located about 3 inches left of the cluster connector takeouts in the instrument panel wiring harness.

| VEHICLE | LOCATION |
|---|---|
| **F-150, F-350, Bronco, E-150, E-350** | On the main trunk of the instrument panel wiring harness, where the RABS module connector pigtail intersects |
| **Explorer, Ranger, Bronco II** | In the master cylinder fluid level sensor wiring harness, on the left fender apron |
| **Aerostar** | 3 inches to the left of the cluster connector takeouts, in the instrument panel wiring harness |

**Figure 21 – Diode/Resistor Location**

The RABS module receives signals, called inputs, from sensors in the system. The module receives its major inputs from the speed sensor and stoplamp switch. Additional input comes from the brake fluid level, valve reset switch and 4 x 4 transmission switches. The module processes these inputs and generates outputs to control the system.

Outputs are signals sent from the module to the devices that perform the desired action. These signals are sent to solenoids that control valves. The solenoids change the output current sent by the module into the desired mechanical action.

During normal braking, hydraulic fluid flows from the master cylinder through the RABS valve to the rear brakes. The isolation solenoid is normally open and the dump solenoid is normally closed (Figure 22).

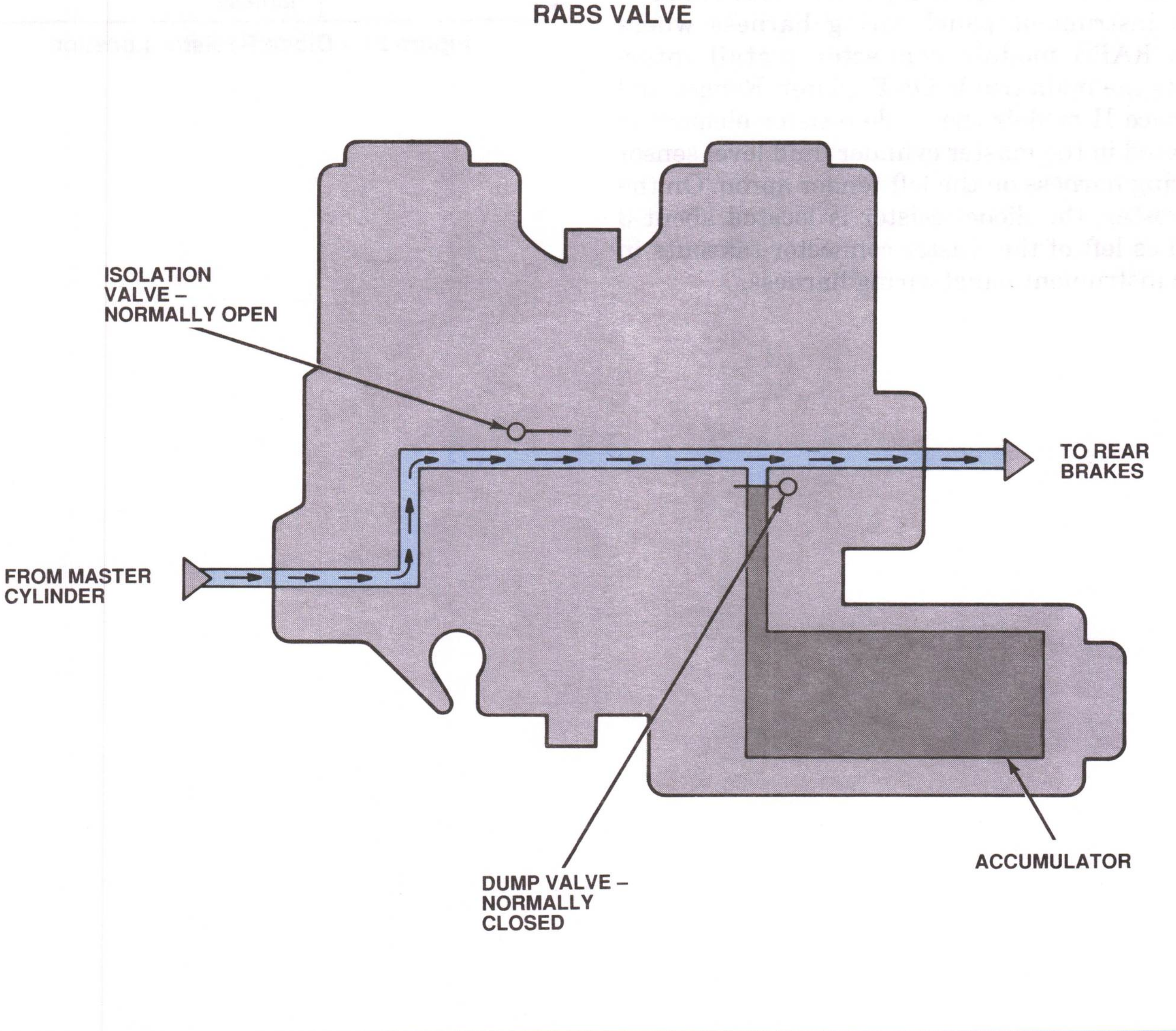


Figure 22 – Brake Fluid Flow During Normal Braking

If the RABS module senses too great of a drop in rear wheel speed, indicating lockup is going to occur, the module energizes the isolation solenoid to close the isolation valve. The rear wheel cylinders are temporarily isolated from the master cylinder and brake pressure cannot increase (Figure 23).

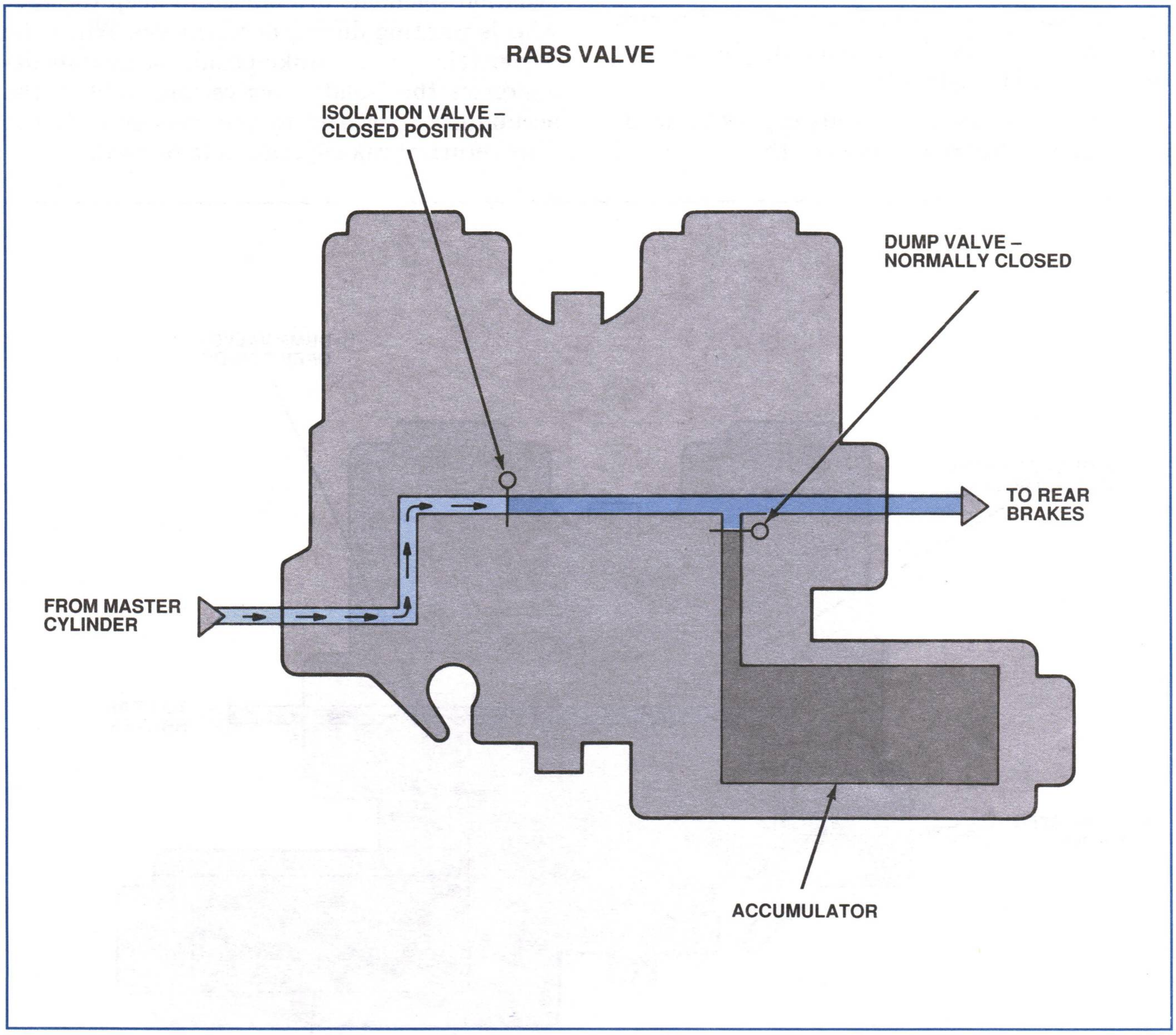

RABS VALVE
ISOLATION VALVE – CLOSED POSITION
DUMP VALVE – NORMALLY CLOSED
TO REAR BRAKES
FROM MASTER CYLINDER
ACCUMULATOR

Figure 23 – Brake Fluid Flow with Isolation Valve Closed

If the rate of deceleration is still too great, the RABS module sends a series of pulses to energize the dump solenoid. This bleeds off the pressure from the rear wheel cylinders into an accumulator built into the RABS valve. This reduces rear wheel cylinder pressure allowing the wheels to spin up to normal vehicle speed (Figure 24).

The valve reset switch signals the RABS module when the difference between the pressure of the input and output of the RABS valve is over 100 psi. It also lets the module know when to de-energize the isolation valve.

Under the RABS module control, the dump and isolation solenoids are pulsed to keep the rear wheels rotating during deceleration. When the driver releases the brake pedal, the module de-energizes the isolation valve and fluid in the accumulator returns to the master cylinder. This returns brake operation to normal.

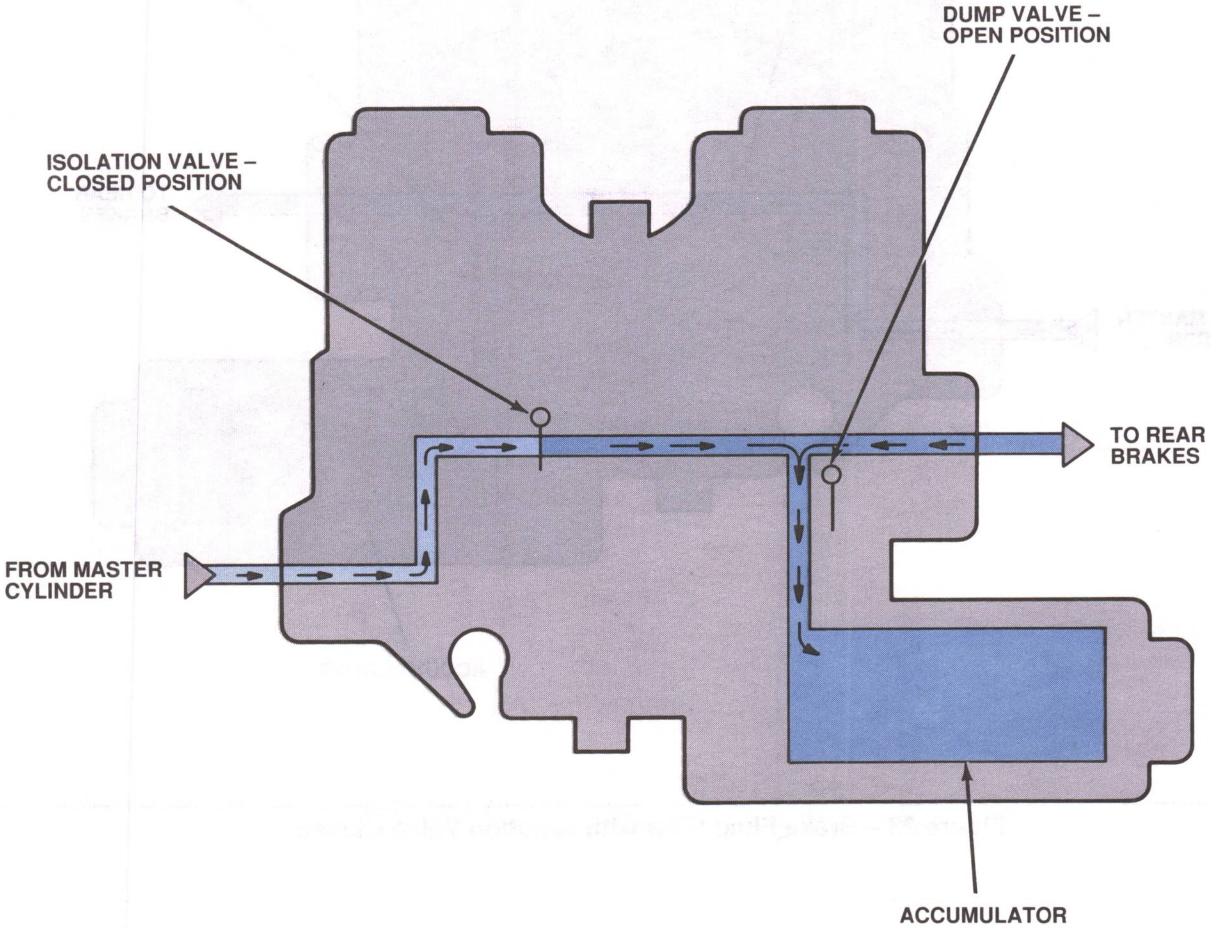


Figure 24 – Brake Fluid Flow with Dump Valve Open, Isolation Valve Closed

## HYDRAULIC SYSTEM BLEEDING

When any part of the brake system is disconnected for repair or replacement, air may get into the hydraulic system. This requires bleeding of the hydraulic system after it has been properly connected to ensure that no air is trapped in the brake cylinders and lines.

The cast iron and aluminum RABS valves have different internal designs. The design of the cast iron valve may allow air to be trapped in the valve. For this reason, it is necessary to bleed the cast iron valve when the brake system is serviced. On E-Series, F-Series, Bronco and pre-1989 Bronco vehicles, the RABS valve should be bled before the rear wheel cylinders are bled. The aluminum RABS valve used on Explorer, Ranger, Aerostar and 1989 and newer Bronco II vehicles does not have a bleed valve.

## ELECTRICAL CIRCUITS

RABS malfunctions may be caused by opens or shorts in the electrical circuits used in the system (Figure 25). Opens caused by damage are usually visually evident. If the wire was broken by vibration, it may have an open within its insulated covering that can only be found by testing. Short circuits may be caused by damage or wear. Look for obvious fraying or bare wires. Shorts or opens may be intermittent. To find an intermittent open or short, wiggle the circuit wiring by hand to see if you can cause the symptom to come and go.

### Fuses

The three fuses that directly affect RABS operation are located in the fuse box. They are:

- A 20 amp fuse that protects the total RABS
- A 15 amp fuse that protects the red BRAKE and yellow REAR ANTILOCK lamps
- A 15 amp fuse that protects the four-way stoplamp cluster.

## INSTRUMENT PANEL LAMPS

The RABS system uses the red BRAKE and yellow REAR ANTILOCK warning lamps on the instrument panel to alert the driver of a system malfunction. Both lamps must be working properly for proper symptom diagnosis.

The red BRAKE lamp is used to indicate a low fluid level condition, a parking brake applied condition, or a low vacuum condition (diesel engines). A low fluid condition may also cause the yellow REAR ANTILOCK lamp to light. To verify operation of this lamp, turn the key to the START position and check the lamp. The lamp should light and go off when the key is placed in the ON position. If the lamp fails to light, service of the electrical system is required.

If the red BRAKE lamp remains on after the key is placed in the run position, repair the brake system as required. If the brake system is okay, follow the troubleshooting chart found later in this book.

The yellow REAR ANTILOCK lamp is used to indicate a malfunction in the RABS. It also indicates that the system has been deactivated. To verify operation of this lamp, turn the key to the RUN or START position. The lamp should turn on for about two seconds and then shut off. If the lamp fails to light, service of the circuit is required.

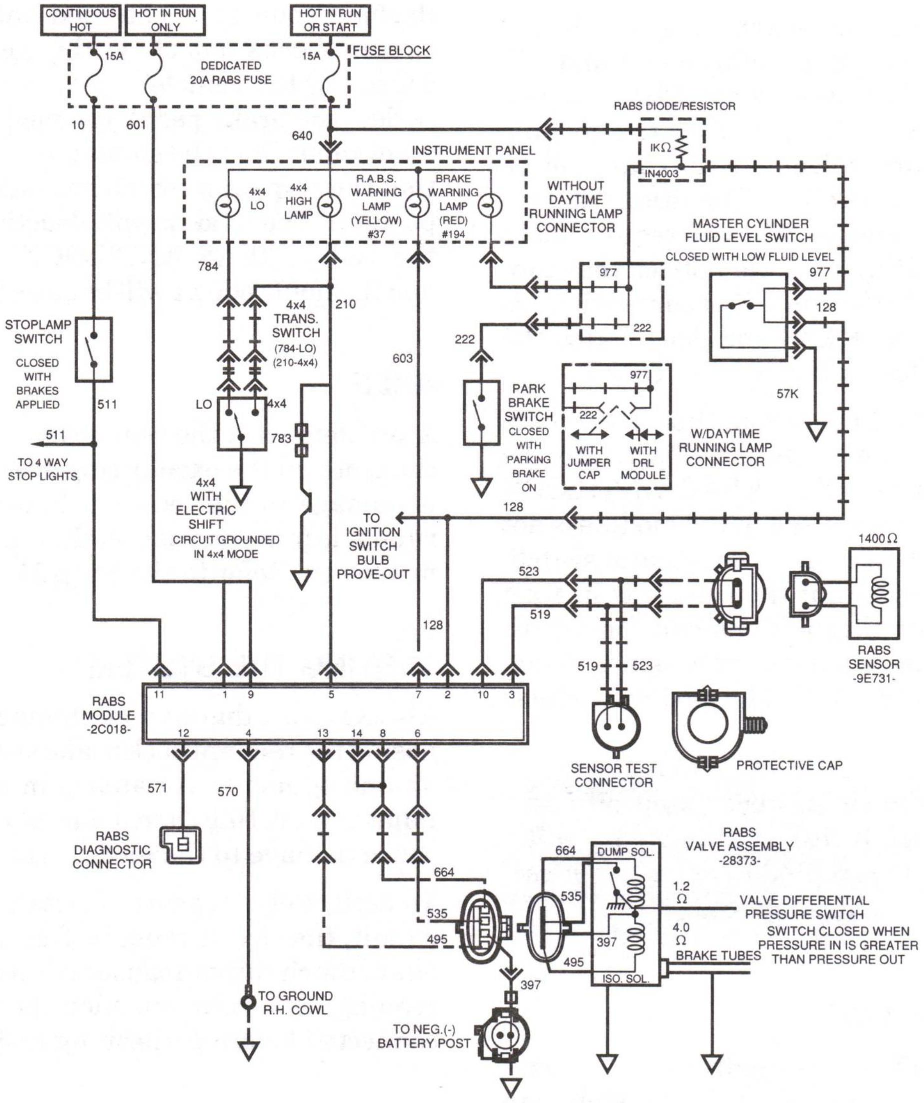
## COMPONENT FAILURE

Components of the RABS may fail and cause the system to be inoperative. The RABS module, RABS valve and speed sensor are serviced as assemblies only and are not to be disassembled. Other components associated with RABS operation may cause the RABS system to operate abnormally. Any problem in the rear brake assemblies or brake hydraulic system may cause the antilock system to malfunction. If the rear brakes tend to stick, they must be serviced.

## EXCITOR RING

The excitor ring is pressed on the differential carrier. If it is removed for any reason, the excitor ring must be discarded and a new ring installed. Different applications require different size excitor rings. Ensure that the replacement ring is the same size and has the same number of teeth as the excitor ring that was removed. Refer to the Brakes — Rear Antilock section in the Shop Manual for excitor ring removal and installation procedures.

The excitor ring used is based on the tire size of the vehicle. If the original tires have been replaced with tires of a different size, RABS operation may be affected. The signal the module receives will not reflect the true vehicle speed. If smaller than original tires are used, the RABS will operate more often than it should. If larger than original tires are used on the vehicle, brake lockup may occur and RABS may not activate. This is especially true if flotation tires ("Monster Mudders") have been placed on the vehicle.



**14 PIN CONNECTOR**

| PIN NO. | COLOR | WIRE NO. | FUNCTION |
|---|---|---|---|
| 1 | LB/PK | 601 | HOT IN RUN ONLY ( + SYSTEM VOLTAGE ) |
| 2 | P/Y | 128 | BRAKE FLUID LEVEL SWITCH |
| 3 | LG/BK | 519 | WHEEL SPEED SENSOR – LOW |
| 4 | BK/W | 570 | MODULE GROUND |
| 5 | LB | 210 | 4x4 SIGNAL INPUT ( LOW WHEN IN 4x4 ) |
| 6 | LB/R | 535 | VALVE RESET INPUT |
| 7 | DG | 603 | RABS FAILURE LAMP |
| 8 | Y/LG | 664 | DUMP SOLENOID OUTPUT |
| 9 | LB/PK | 601 | + SYSTEM VOLTAGE ( RUN ONLY ) |
| 10 | R/PK | 523 | WHEEL SPEED SENSOR – HIGH |
| 11 | LG | 511 | STOP LAMP SWITCH INPUT |
| 12 | BK/O | 571 | DIAGNOSTIC TEST LEAD |
| 13 | TAN | 495 | ISOLATION SOLENOID OUTPUT |
| 14 | Y/LG | 664 | DUMP SOLENOID OUTPUT |

**ADDITIONAL WIRE CIRCUIT NUMBERS USED**

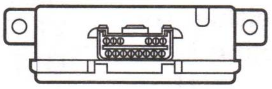
| COLOR | WIRE NO. | FUNCTION |
|---|---|---|
| LG/R | 10 | CONTINUOUS HOT ( STOP LAMP SWITCH ) |
| LB/BK | 222 | PARKING BRAKE SWITCH |
| BK | 57K | FLUID LEVEL SW GROUND |
| BK/W | 397 | RABS VALVE GROUND TO BATTERY TERMINAL |
| R/Y | 640 | HOT IN RUN OR START FEED TO BRAKE, RABS WARNING, 4x4 HI, AND 4x4 LO LAMPS ( CLUSTER ) |
| GY | 783 | 4x4 SHIFT ON THE FLY LIGHT SWITCH |
| P/W | 977 | FROM PARK SWITCH TO MASTER CYLINDER |
| P/Y | 128 | FROM IG SW TO MODULE AND MASTER CYLINDER |
| LB/BK | 784 | 4x4 LO INDIC. LAMP |

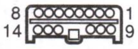
NOTE : ALL VIEWS LOOKING INTO CONNECTOR

**WIRE HARNESS LEGEND**

| | | |
|---|---|---|
| ———— | -14401- | IP HARNESS |
| —+—+—+— | -14290- | ENGINE COMP. |
| — — — — | -14405- | FRAME RAIL |
| /////// | -14A407- | JUMPER |
| —□—□— | -7A786- | |
| —‖— | -14K067- | |
| —□— | -12A581- | |

RABS MODULE
-2C018-





RABS MODULE
HARNESS CONNECTOR

Figure 25 – Typical RABS Wiring Diagram

## 4 X 4 INDICATOR SWITCH

If the 4 x 4 indicator switch fails, the RABS module will not receive a signal from it and will assume the vehicle is in 4 x 2 operation. During normal 4 x 2 antilock operation, the module energizes the dump solenoid a maximum of 16 times without interruption. Conditions experienced in 4 x 2 operation will not require more than 16 dumps. If the module notices that conditions call for a 17th dump, it assumes there is a problem with the RABS and deactivates the system. The module will also store code 5.

During normal 4 x 4 operation, the module only allows 16 dumps but does not deactivate the RABS or light the yellow REAR ANTILOCK lamp if 16 dumps are pulsed. If the module is not receiving a signal from the 4 x 4 indicator switch, it does not recognize that the vehicle is in 4 x 4 operation and when conditions call for a 17th dump, the module assumes there is a problem and deactivates the RABS. The module will also store code 5.

**NOTE**: If the vehicle has been shut off and the flashout code is lost, it may be difficult for the technician to reproduce the conditions that generated the flashout code.

## STOPLAMP SWITCH

The stoplamp switch is normally open. It closes when the brakes are applied. If the stoplamp switch fails in the open position, the RABS module cannot recognize when the brakes are applied and will not activate the RABS. The rear brakes may lock up during sudden stops and the system will not indicate any malfunction. A failed open in the stoplamp circuit cannot be detected by the RABS module.

If the stoplamp switch fails in the closed position, flashout code 11 will be stored. At vehicle speeds between 10 and 35 mph, neither the BRAKE nor REAR ANTILOCK warning lamp will light. At vehicle speeds greater than 35 mph, the module may store flashout code 11.

On vehicles with an automatic transmission, if flashout code 11 is obtained and the stoplamp circuit checks out okay, the condition may be caused by the vehicle's operator. If the operator "rides" the brake pedal, the module detects constant input from the stoplamp circuit and thinks that the stoplamp switch has failed in the closed position. The module will deactivate the RABS, the yellow REAR ANTILOCK lamp will light and flashout code 11 will be stored by the module.

## AXLE

A problem with the rear axle is indicated when the teeth on the excitor ring are damaged, there is damage to the sensor pole piece or if lateral runout is present. Inspect the axle and service as necessary. Refer to the Shop Manual.

## TESTING THE SYSTEM

Always use a digital volt-ohmmeter when diagnosing the rear antilock brake system. Never use an analog meter. An analog meter has a lower impedance rating than a digital meter and could cause damage to the module (Figure 26).

To accurately measure resistance in the RABS circuit, the circuit must be free of voltage. Voltage in the circuit can cause an incorrect resistance reading. It is recommended the battery be disconnected before performing resistance checks.

## TROUBLESHOOTING CHART

The RABS Troubleshooting Chart (Figure 27) provides an efficient and accurate procedure for diagnosis. The chart must be followed in sequence. Bypassing steps or not following the steps in the order given may lead to unnecessary parts replacement or incorrect diagnosis.

If the REAR ANTILOCK lamp is on, obtain the flashout code before shutting off the vehicle. The code is lost when the key is turned to the OFF position.

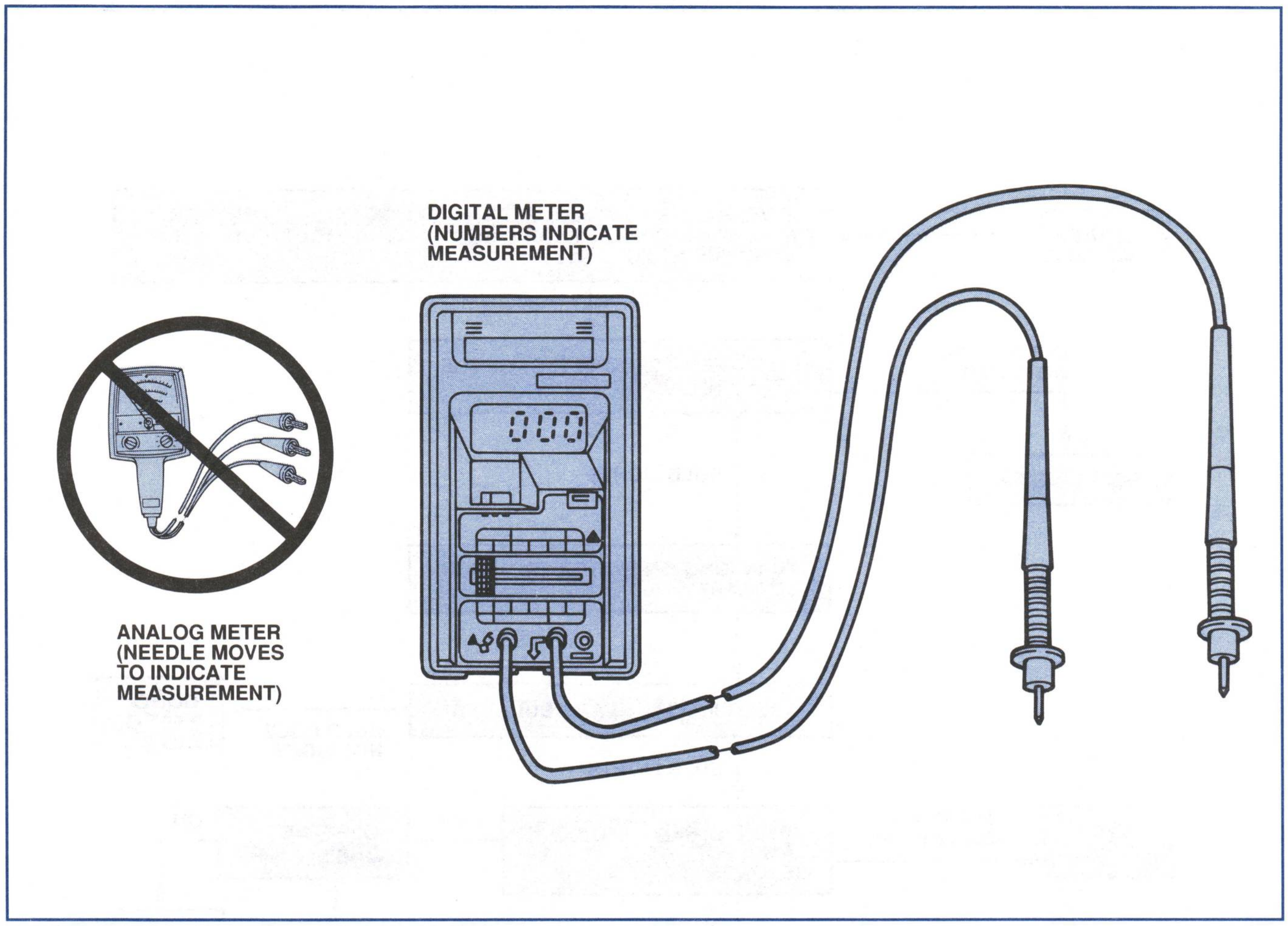


Figure 26 – Always Use a Digital Volt-Ohmmeter

## IF RABS IS COMPLETELY INOPERATIVE

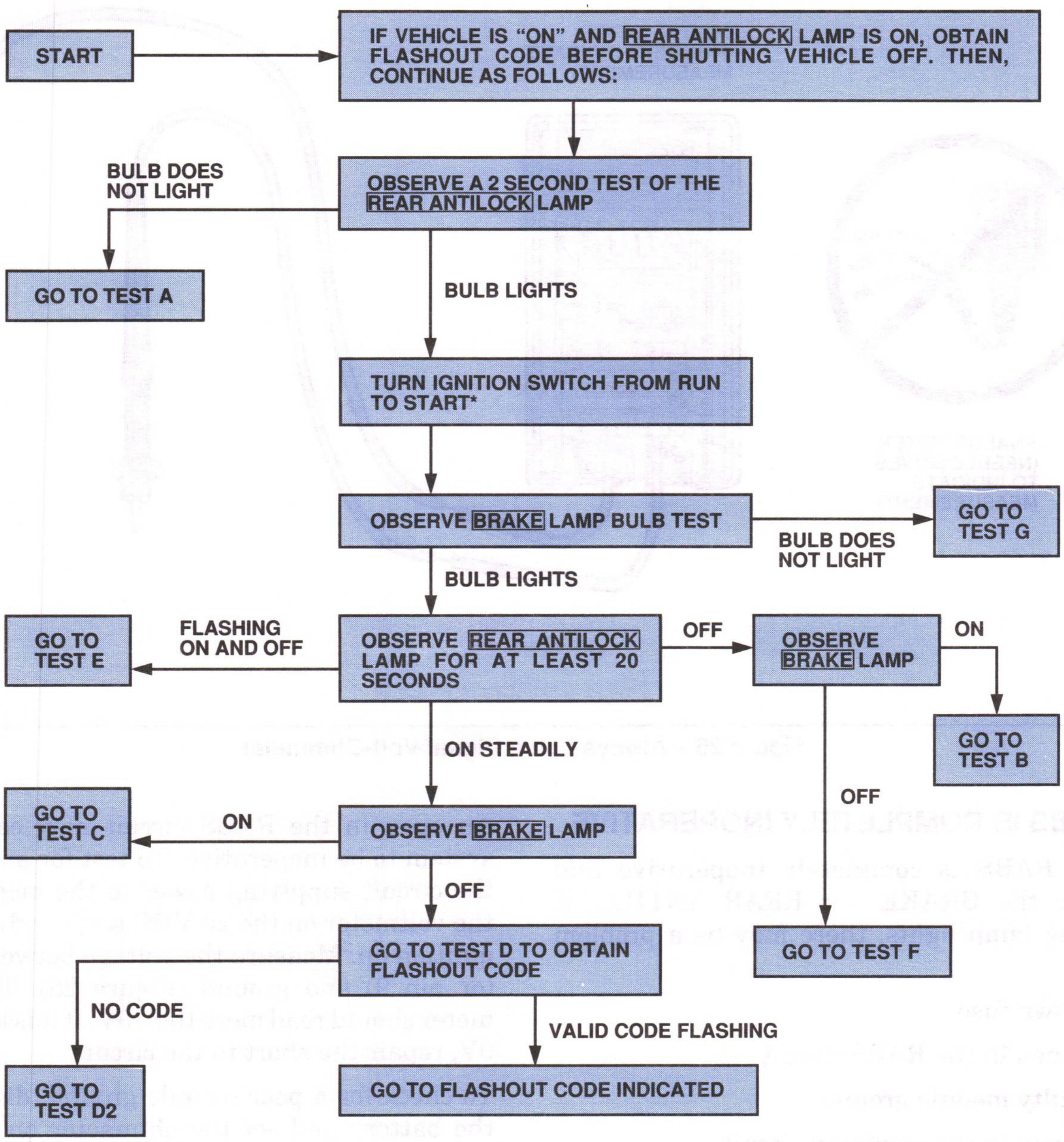
If the RABS is completely inoperative and neither the BRAKE nor REAR ANTILOCK warning lamp lights, there may be a problem with:

- A blown fuse
- An open in the RABS circuit
- A faulty module ground
- An open in the stoplamp circuit

Check the 20 amp RABS fuse in the interior fuse panel. If the fuse is blown, check for a short to ground in the RABS power circuit between the fuse panel and the RABS module. Repair the short and replace the fuse.

An open in the RABS circuit may cause the system to be inoperative. To test for an open in the circuit supplying power to the module, set the voltmeter on the 20 VDC scale and turn the ignition on. Measure the voltage between pin 1 (or pin 9) and ground (Figure 28). The voltmeter should read more than 9V. If it is less than 9V, repair the short in the circuit.

To check for a poor module ground, disconnect the battery and set the ohmmeter on the 200 ohm scale. Test the resistance between pin 4 of the module harness connector and ground. Resistance should be less than 1 ohm and steady. If resistance is greater than 1 ohm or fluctuates, repair the poor ground in the module circuit.


START
IF VEHICLE IS "ON" AND REAR ANTILOCK LAMP IS ON, OBTAIN FLASHOUT CODE BEFORE SHUTTING VEHICLE OFF. THEN, CONTINUE AS FOLLOWS:
BULB DOES NOT LIGHT
OBSERVE A 2 SECOND TEST OF THE REAR ANTILOCK LAMP
GO TO TEST A
BULB LIGHTS
TURN IGNITION SWITCH FROM RUN TO START*
OBSERVE BRAKE LAMP BULB TEST
GO TO TEST G
BULB DOES NOT LIGHT
BULB LIGHTS
GO TO TEST E
FLASHING ON AND OFF
OBSERVE REAR ANTILOCK LAMP FOR AT LEAST 20 SECONDS
OFF
OBSERVE BRAKE LAMP
ON
GO TO TEST B
ON STEADILY
OFF
GO TO TEST C
ON
OBSERVE BRAKE LAMP
OFF
GO TO TEST D TO OBTAIN FLASHOUT CODE
GO TO TEST F
NO CODE
VALID CODE FLASHING
GO TO TEST D2
GO TO FLASHOUT CODE INDICATED

*NOTE: THE REAR ANTILOCK BULB TEST MAY BE REPEATED HERE.

Figure 27 – Rear Antilock Brake System Troubleshooting Chart

If the RABS module is not receiving an input from the stoplamp switch, the RABS will not activate. To test for an open between the stoplamp switch and the module, turn the ignition off and set the voltmeter to the 20 VDC scale. Remove the module harness connector and measure the voltage between pin 11 and ground while stepping on the brake pedal. If the voltmeter reads less than 9V, repair the open in the stoplamp switch circuit.

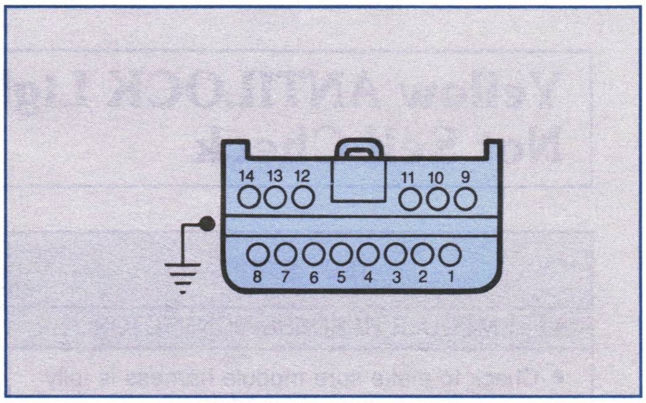
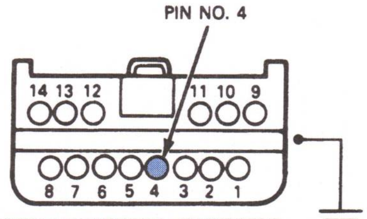
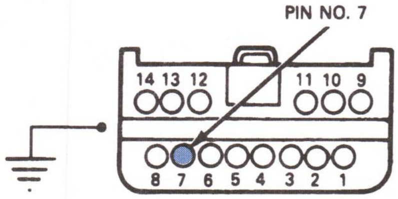


Figure 28 – Module Harness Connector — Pin View

# Yellow ANTILOCK Light Off and Does Not Self-Check

## Test A

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **A1** MODULE HARNESS CONNECTOR | | |
| • Check to make sure module harness is fully plugged into computer module. | Harness is fully plugged in ▶ | GO to Test **A2**. |
| | Harness is not fully plugged in ▶ | CONNECT harness to module. |
| **A2** COMPUTER MODULE GROUND | | |
| • Check for good computer module ground:<br>1. Disconnect battery.<br>2. Remove harness connector from module.<br>3. Set ohmmeter on the 200 ohm scale.<br>4. Check for resistance between harness connector pin 4 and chassis ground.<br> <br>MODULE HARNESS CONNECTOR — PIN VIEW<br>**CAUTION: WHEN CHECKING RESISTANCE IN THE ANTILOCK SYSTEM, ALWAYS DISCONNECT THE BATTERY. IMPROPER RESISTANCE MAY OCCUR WITH THE VEHICLE BATTERY CONNECTED.** | Resistance less than 1 ohm ▶ | GO to Test **A3**. |
| | Resistance 1 ohm or greater ▶ | CHECK for open in module ground wire. CHECK for loose, dirty or broken connector pins. |
| **A3** ANTILOCK LIGHT POWER | | |
| • Check for voltage to ANTILOCK light:<br>1. Reconnect the battery.<br>2. Set voltmeter on 20 VDC scale position.<br>3. Turn ignition to the on position.<br>4. Check voltage between harness connector pin 7 and a known good chassis ground.<br> <br>MODULE HARNESS CONNECTOR — PIN VIEW | Voltage greater than 9V ▶ | REPLACE module. |
| | Voltage less than 9V ▶ | GO to Test **A4**. |

# Yellow ANTILOCK Light Off and Does Not Self-Check (Cont'd)

## Test A

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **A4** RABS 15 AMP LIGHT FUSE | | |
| • Remove and inspect RABS 15 amp light fuse. | Fuse is OK ▶ | REPLACE fuse and GO to Test **A5**. |
| | Fuse is blown ▶ | CHECK for short to ground between fuse panel and warning lamps. REPAIR short and replace 15 amp fuse. |
| **A5** POWER TO RABS LIGHT FUSE | | |
| • Check for voltage to fuse.<br>1. Set voltmeter to 20 VDC scale.<br>2. Turn ignition to the on position.<br>3. Check voltage between panel fuse connector and known good chassis ground. | Voltage greater than 9V ▶ | GO to Test **A6**. |
| | Voltage less than 9V ▶ | REPAIR fuse panel or vehicle electrical system. |
| **A6** RABS SELF-CHECK | | |
| • Check for RABS self-check<br>1. Turn ignition to ON position. Listen for "click" sound from RABS valve. | Click is heard ▶ | GO to Test **A7**. |
| | No click is heard ▶ | GO to Test **A1**. |
| **A7** RABS LIGHT BULB | | |
| • Check RABS light bulb. | Bulb is OK ▶ | REPAIR open between RABS light fuse and pin 7 of the module wiring harness connector. |
| | Bulb is not OK ▶ | REPLACE bulb. |

# Red BRAKE Light On, Yellow ANTILOCK Light Off, and ANTILOCK Light Does Self-Check

## Test B

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **B1** PARKING BRAKE | | |
| • Check parking brake application:<br>1. Turn ignition key to the on position.<br>2. Check the parking brake pedal and release if applied. | BRAKE light goes off ▶ | PERFORM road test. If lockup occurs GO to Test **B2**. |
| | BRAKE light stays on ▶ | GO to Test **B2**. |
| **B2** PARKING BRAKE SWITCH | | |
| • Check parking brake switch:<br>1. Disconnect the parking brake switch connector. | BRAKE light goes off ▶ | ADJUST parking brake or REPLACE parking brake switch. |
| | BRAKE light remains on ▶ | GO to Test **B3**. |
| **B3** MODULE AND WIRING | | |
| • Remove module harness connector from module. | BRAKE light goes off ▶ | REPLACE the computer module. |
| | If BRAKE light remains on ▶ | CHECK for short to ground in wiring from BRAKE light to the RABS diode/resistor. |

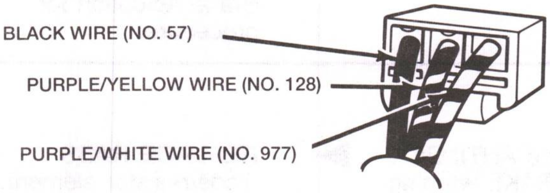
# Yellow ANTILOCK Light On and Red BRAKE Light On

## Test C

| TEST STEP | RESULT ► | ACTION TO TAKE |
|---|---|---|
| **C1** LOW BRAKE FLUID | | |
| • Check the brake fluid level at the master cylinder resevoir (or shuttled differential switch in Aerostar). | Brake fluid level (and differential switch) OK | GO to Test **C2**. |
| | Brake fluid level low or differential switch shuttled | CHECK for fluid leaks in vehicle brake system and repair as required. Fill master cylinder to required level. |
| **C2** MASTER CYLINDER FLOAT | | |
| • Check master cylinder float for buoyancy:<br>1. Remove cap from master cylinder reservoir.<br>2. Using a clean steel implement, push down on float in reservoir. | Float moves down | GO to Test **C3**. |
| | Float does not move down (sits at the bottom of the reservoir) | REPLACE master cylinder reservoir. REFER to Section 06-06 Hydraulic Brake Actuation for procedure. |
| **C3** DIODE/RESISTOR ELEMENT | | |
| • Check for proper functioning of the diode/resistor element.<br>1. Turn ignition key to the on position.<br>2. Check parking brake and release if applied. | Both the ANTILOCK and BRAKE warning lamps go off | REPLACE RABS diode/resistor element. |
| | Both the ANTILOCK and BRAKE warning lamps stay on | GO to Test **C4**. |
| **C4** DIODE/RESISTOR ELEMENT CONTINUED | | |
| • Continue to check for proper functioning of the diode/resistor element.<br>1. Remove the parking brake switch and the diesel low vacuum switch, if so equipped. | Both the ANTILOCK and BRAKE warning lamps go off | REPLACE RABS diode/resistor element. |
| | Both the ANTILOCK and BRAKE warning lamps stay on | GO to Test **C5**. |

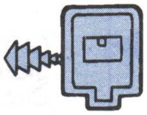
# Yellow ANTILOCK Light On and Red BRAKE Light On — Cont'd

## Test C

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **C5** ANTILOCK VALVE SWITCH | | |
| • Obtain the flashout code as described in Diagnosis and Testing in this Section. | Flashout code is obtained ▶ | REFER to Flashout Codes Charts in this Section. |
| | ANTILOCK and BRAKE warning lamps stay on steady ▶ | GO to Test **C6**. |
| **C6** MASTER CYLINDER SWITCH | | |
| • Check for proper functioning of the master cylinder fluid level indicator switch:<br>1. Remove the connector from the master cylinder.<br>2. Connect a jumper wire between the purple/yellow wire (No. 128), and the purple/white wire (No. 977).<br>3. Turn the ignition key to the on position.<br><br> BLACK WIRE (NO. 57)<br>PURPLE/YELLOW WIRE (NO. 128)<br>PURPLE/WHITE WIRE (NO. 977) | ANTILOCK and BRAKE warning lamps stay on ▶ | GO to Test **C7**. |
| | ANTILOCK and BRAKE warning lamps go off ▶ | REPLACE the master cylinder reservoir. REFER to Section 06-06 Hydraulic Brake Actuation for procedure. |
| **C7** BRAKE LIGHT WIRING | | |
| • Check for shorts in brake light wiring.<br>1. Disconnect module harness connector from module.<br>2. Turn ignition key to the on position. | ANTILOCK light goes off and BRAKE light stays on ▶ | CHECK for short to ground in the 977 and 128 circuit. REFER to wiring diagram in this Section. |
| | Both ANTILOCK and BRAKE warning lamps go off ▶ | REPLACE module. |

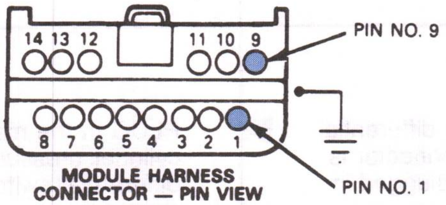
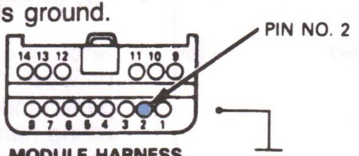
# Yellow ANTILOCK Light On, Red BRAKE Light Off

## Test D

| TEST STEP | | RESULT ▶ | ACTION TO TAKE |
|---|---|---|---|
| **D1** | **OBTAIN THE FLASHOUT CODE** | | |
| | • Obtain the flashout code as described in Diagnosis and Testing in this Section.<br><br>RABS DIAGNOSTIC CONNECTOR — PIN VIEW | Flashout code cannot be obtained ▶ | GO to Test **D2**. |
| | | Flashout code is obtained ▶ | Refer to the Flashout Code Charts in this Section. |
| **D2** | **MASTER CYLINDER CONNECTOR** | | |
| | • Make sure master cylinder connector is fully plugged in. | Master cylinder connector is not fully plugged in ▶ | PLUG in the master cylinder connector. |
| | | Master cylinder connector is plugged in ▶ | GO to Test **D2A**. |
| **D2A** | **M/C PRESS. DIFFERENTIAL CONNECTOR** | | |
| | • Make sure master cylinder pressure differential connector is fully plugged in (Aerostar only). | Pressure differential switch connector is not fully plugged in ▶ | PLUG in the master cylinder pressure differential switch connector. |
| | | Pressure differential switch connector is plugged in ▶ | GO to Test **D3**. |
| **D3** | **RABS 20 AMP FUSE** | | |
| | • Remove and inspect the RABS 20 amp fuse. | Fuse is OK ▶ | REPLACE Fuse. GO to Test **D4**. |
| | | Fuse is blown ▶ | Short to ground between the fuse panel and the module wiring harness connector. REPAIR short in the 601 or 601A circuit and REPLACE the 20 amp fuse. REFER to the Wiring Diagrams in this Section. |

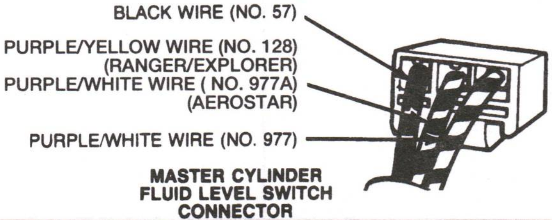
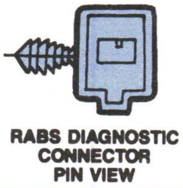
# Yellow ANTILOCK Light On, Red BRAKE Light Off (Cont'd)

## Test D

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **D4** SHORTS IN MODULE HARNESS CONNECTOR WIRING | | |
| • Check wiring for short to ground:<br>1. Turn ignition switch to the on position.<br>2. Remove the module harness connector from the module.<br>3. Observe the REAR ANTILOCK light. | Light goes off ▶ | GO to Test **D5**. |
| | Light remains on ▶ | CHECK for a short to ground in the 603 Circuit. REFER to Wiring Diagram in this Section. |
| **D5** POWER TO THE MODULE | | |
| • Check for an open in the circuit supplying power to the module:<br>1. Set the voltmeter on the 20 VDC scale.<br>2. Turn the ignition switch to the on position.<br>3. Measure the voltage between pin 1 (or pin 9) and chassis ground.<br> 14 13 12<br>11 10 9<br>PIN NO. 9<br>8 7 6 5 4 3 2 1<br>PIN NO. 1<br>MODULE HARNESS CONNECTOR — PIN VIEW | Voltage less than 9V. ▶ | REPAIR the open in the 601 or 601A circuit or power to the fuse panel. See Wiring Diagram. |
| | Voltage greater than 9V. ▶ | GO to Test **D6**. |
| **D6** VOLTAGE AT THE FLUID LEVEL CIRCUIT | | |
| • Check the voltage from the fluid level switch circuit:<br>1. Set the voltmeter on the 20 VDC scale.<br>2. Turn the ignition switch to the on position.<br>3. Measure the voltage between pin 2 and chassis ground.<br> <br>MODULE HARNESS CONNECTOR — PIN VIEW | Voltage less than 8V. ▶ | GO to Test **D7**. |
| | Voltage greater than 8V. ▶ | GO to Test **D8**. |

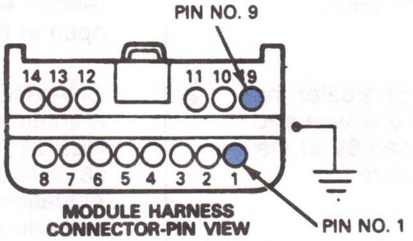
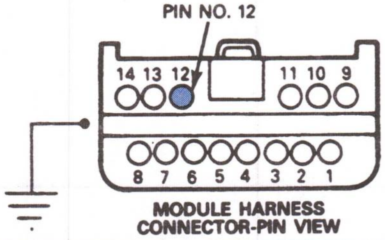
# Yellow ANTILOCK Light On, Red BRAKE Light Off (Cont'd)

## Test D

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **D7** FLUID LEVEL SENSOR AND WIRING | | |
| • Check for voltage at the fluid level sensor:<br>1. Set voltmeter on the 20 VDC scale.<br>2. Turn the ignition switch to the on position.<br>3. Measure the voltage at the purple/white wire (No. 977), and at the purple/yellow wire (No. 128) at the back of the master cylinder fluid level switch connector without disconnecting the connector.<br> BLACK WIRE (NO. 57)<br>PURPLE/YELLOW WIRE (NO. 128) (RANGER/EXPLORER)<br>PURPLE/WHITE WIRE ( NO. 977A) (AEROSTAR)<br>PURPLE/WHITE WIRE (NO. 977)<br>MASTER CYLINDER FLUID LEVEL SWITCH CONNECTOR | Voltage greater than 8V at both wires. ▶ | CHECK for open in 128 (Ranger) or 977A (Aerostar) and 977 circuits. |
| | Voltage less than 8V at both wires. ▶ | REPLACE diode resistor element or open in 640 circuit. |
| | Voltage greater than 8V at one wire and less than 8V at the other wire. ▶ | CHANGE the master cylinder reservoir. REFER to Section 06-06 Hydraulic Brake Actuation for procedure. |
| **D8** GROUNDED DIAGNOSTIC LEAD | | |
| • Check the voltage at the diagnostic lead.<br>1. Reconnect the module harness connector.<br>2. Set the voltmeter on the 20 VDC scale.<br>3. Turn the ignition to the on position.<br>4. Measure the voltage between the diagnostic lead and chassis ground.<br> | Voltage is less than 1V ▶ | CHECK for a short in the 571 diagnostic circuit. If no short is found, GO to Test **D9**. |
| | Voltage is greater than 1V ▶ | GO to Test **D9**. |
| **D9** COMPUTER MODULE | | |
| • Replace computer module and retest. | | |

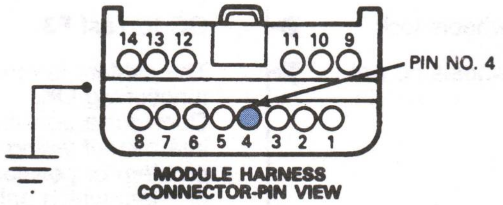
# Yellow ANTILOCK Light Flashing, Red BRAKE Light Off

## Test E

| TEST STEP | RESULT | ACTION TO TAKE |
|---|---|---|
| **E1 INTERMITTENT POWER TO MODULE** | | |
| • Check for intermittent open in the 601 and 601A circuit, power to module.<br>1. Remove the module harness connector from the module.<br>2. Set the voltmeter on the 20 VDC scale.<br>3. Turn the ignition to the ON position.<br>4. Shake the instrument panel harness. Check for battery voltage between pin 1 (and pin 9) and chassis ground.<br><br> PIN NO. 9<br>14 13 12<br>11 10 9<br>8 7 6 5 4 3 2 1<br>PIN NO. 1<br>MODULE HARNESS CONNECTOR-PIN VIEW | Voltage is steady and greater than 9V | GO to Test **E2**. |
| | Voltage is intermittent or less than 9V | REPAIR break in the 601 and 601A circuit. REFER to Wiring Diagram in this Section. |
| **E2 GROUNDED DIAGNOSTIC LEAD** | | |
| • Check for an intermittent ground to chassis in the diagnostic lead circuit:<br>1. Turn the ignition switch off.<br>2. Disconnect the battery.<br>3. Set the ohmmeter on the 200K ohm scale.<br>4. Shake the module harness and check the resistance between pin 12 and chassis ground.<br><br> <br>MODULE HARNESS CONNECTOR-PIN VIEW | Resistance is steady and greater than 100K ohms | GO to Test **E3**. |
| | Resistance is below 100K ohms or fluctuates | REPAIR short in the 571 circuit. REFER to Wiring Diagram in this Section. |
| **E3 OPEN FLUID LEVEL SENSOR CIRCUIT** | | |
| • Check for an open in the fluid level sensor circuit:<br>1. Set voltmeter on 20 VDC scale.<br>2. Turn ignition to the ON position.<br>3. Measure the voltage between pin 2 and ground while shaking the fluid level sensor harness. | Voltage is steady | CHECK brake fluid level in master cylinder. |
| | Voltage is intermittent | REPAIR open in fluid level sensor circuit. |
| | No voltage | GO to **E4**. |

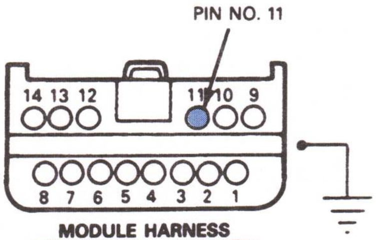
# Yellow ANTILOCK Light Flashing, Red BRAKE Light Off (Continued)

## Test E

| E4 FAULTY MODULE GROUND | | |
|---|---|---|
| • Check for intermittent or poor module ground:<br>1. Disconnect the battery.<br>2. Set the voltmeter on the 200 ohm scale.<br>3. Shake the module harness and check the resistance between pin 4 of the module harness connector and chassis ground.<br><br> <br>MODULE HARNESS CONNECTOR-PIN VIEW | Resistance is less than 1 ohm and steady ▶ | REPLACE module. |
| | Resistance is greater than 1 ohm or fluctuates ▶ | REPAIR poor ground in the 570 circuit. REFER to Wiring Diagrams in this Section. |

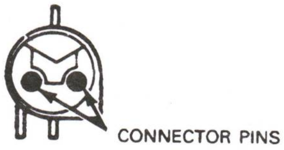
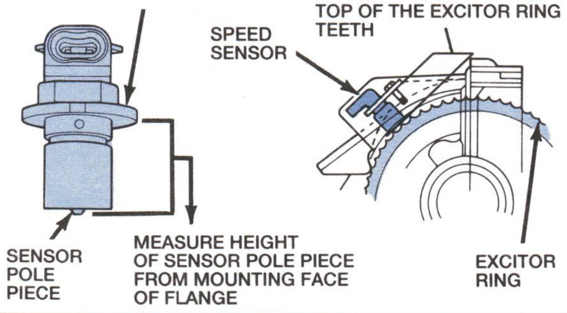
# Rear Wheels Lock with Hard Stops — Both Lamps Functioning Properly

## Test F

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **F1** STOPLAMPS | | |
| • Check for stoplamp operation:<br>1. Apply the service brakes and observe the rear brakelamps. | Rear stoplamps not illuminated ▶ | REPAIR the stoplamp circuit. |
| | Rear stoplamps OK ▶ | GO to Test **F2**. |
| **F2** VEHICLE ROAD TEST | | |
| • Perform a low speed vehicle road test:<br>1. At approximately 10 mph apply the service brakes in an attempt to lock all four wheels while observing the left rear wheel in the side mirror. | Rear wheels lock ▶ | GO to Test **F3**. |
| | Rear wheels do not lock ▶ | The system is now functioning OK. Consider a possible intermittent wiring problem or possibly a problem which only shows up during driving. REFER to Flashout Code 6 in this Section. |
| **F3** WIRING FROM MODULE TO BRAKE SWITCH | | |
| • Check for an open between the brake switch and the module:<br>1. Turn the ignition off.<br>2. Set the voltmeter on the 20 VDC scale.<br>3. Remove the module harness connector.<br>4. Measure the voltage between pin 11 and chassis ground while stepping on the brake pedal.<br> <br>MODULE HARNESS CONNECTOR — PIN VIEW | Voltage is less than 9V ▶ | REPAIR the open in the 511 circuit. |
| | Voltage is 9V or more ▶ | GO to Test **F4**. |
| **F4** EXCITOR RING INSPECTION | | |
| • Remove sensor from carrier and check for:<br>1. Presence of the excitor ring<br>2. Condition of the teeth. | Ring is present with the teeth intact ▶ | REINSTALL the sensor and GO to Test **F5**. |
| | Ring is not present or the teeth are damaged ▶ | REPAIR axle. REFER to the appropriate Section in Group 05 for procedure. |

# Rear Wheels Lock with Hard Stops — Both Lamps Functioning Properly (Continued)

## Test F

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **F5** SENSOR OUTPUT | | |
| - Check for low sensor signal output:<br>1. Set the voltmeter on the 2000 mV AC scale.<br>2. Position the vehicle on the hoist and raise the rear wheels off the ground.<br>3. Remove the cap from the sensor test connector and connect the voltmeter across the connector leads.<br>4. Start the engine and turn the rear wheels at 5 mph.<br>5. Measure the voltage output of the sensor.<br> <br>**SENSOR TEST CONNECTOR – PIN VIEW** | Voltage is 650 mV (RMS) or greater ▶ | REINSTALL the sensor test connector cap and GO to Test **F7**. |
| | Voltage is less than 650 mV (RMS) ▶ | REPLACE the sensor, RETEST, and REINSTALL the sensor test connector cap.<br>If the voltage is still low, GO to Test **F6**. |
| **F6** SENSOR GAP | | |
| - Determine the sensor gap:<br>1. Remove the sensor from the carrier.<br>2. Measure the height of the sensor pole piece from the mounting face of the sensor flange. Pole should be 27.18-27.43 mm (1.07-1.08 inch).<br>3. Measure the depth to the top of the excitor ring teeth from the sensor mounting face on the carrier.<br>4. Subtract the two measurements. This is the sensor gap.<br> MEASURE DEPTH FROM SENSOR MOUNTING FACE OF THE CARRIER TO THE TOP OF THE EXCITOR RING TEETH<br>MOUNTING FLANGE<br>SPEED SENSOR<br>SENSOR POLE PIECE<br>MEASURE HEIGHT OF SENSOR POLE PIECE FROM MOUNTING FACE OF FLANGE<br>EXCITOR RING | Gap is less than 1.27 mm (0.050 inches) ▶ | GO to Test **F7**. |
| | Gap is greater than 0.050 inches ▶ | The gap is too large. CHECK for defective sensor or carrier housing. |

## Rear Wheels Lock with Hard Stops — Both Lamps Functioning Properly (Continued)

## Test F

| | | | |
|---|---|---|---|
| **F7** | MECHANICAL PROBLEMS IN REAR BRAKES | | |
| | • Check the rear brakes for mechanical problems such as grabbing, locking or pulling. | Rear Brakes OK ▶ | GO to Test **F8**. |
| | | Rear brakes lock, grab or pull ▶ | REPAIR and RETEST. |
| **F8** | COMPUTER MODULE | | |
| | • Replace computer module and retest. | | |

# Yellow ANTILOCK Light Self Checks, Red BRAKE Light Does Not Self Check

## Test G

| TEST STEP | | RESULT ▶ | ACTION TO TAKE |
|---|---|---|---|
| **G1** | MASTER CYLINDER CONNECTORS | | |
| | • Check connectors on master cylinder, brake fluid level switch and delta pressure switch if equipped. | Connectors are fully plugged in ▶ | GO to Test **G2**. |
| | | Connector is not fully plugged in ▶ | CONNECT connector to master cylinder. |
| **G2** | RED BRAKE WARNING LIGHT | | |
| | • Apply parking brake to see if red brake warning light lights. | Red warning light lights ▶ | GO to Test **G3**. |
| | | Red warning light does not light ▶ | REPAIR warning lamp circuit. CHECK for open bulb. |
| **G3** | CANADIAN RUNNING LIGHTS MODULE | | |
| | • If vehicle is equipped with Canadian running lights, check that module is connected. | Connector fully plugged in ▶ | GO to Test **D6**. |
| | | Connector loose ▶ | Secure connection and recheck. |

# FLASHOUT CODES

When the yellow REAR ANTILOCK lamp illuminates during normal vehicle operation, a flashout code may be stored in the module memory to aid in diagnosis. The yellow REAR ANTILOCK lamp should stay on steadily. If the red BRAKE lamp is also on, no flashout code may be generated by the system due to a poor ground in the fluid level circuit or low fluid level.

## ACCESSING THE FLASHOUT CODE

If the vehicle is shut off before the code is read, the code will be lost. If the code is lost, it may reappear when the vehicle is started or the vehicle may need to be driven to reproduce the problem. If the problem is intermittent or if the problem is only evident under certain driving conditions, it may be difficult for the technician to reproduce the code.

To access flashout codes, drive the vehicle to a level area and place the shift lever in park (automatic transmission) or neutral (manual transmission). Apply the parking brake and place blocks behind the rear wheels and in front of the front wheels to prevent the vehicle from moving.

Locate the RABS diagnostic connector and attach a jumper wire to the black/orange wire. Momentarily ground the wire (for more than 1 second). When the ground is made and then broken, the REAR ANTILOCK lamp should begin to flash the diagnostic code.

The code consists of a number of short flashes followed by a long flash. Count the number of flashes (short flashes plus the long flash). The number of flashes indicates the flashout code. The code will repeat until the ignition switch is turned off. Read the code several times to verify it. The first reading may be inaccurate because the code may have started in the middle. If there is more than one system fault, only the first flashout code can be obtained. The condition that code is generated from must be repaired and the system retested to access the next flashout code.

# No Flashout Code

**Flashout Code 0**

| TEST STEP | | RESULT ▶ | ACTION TO TAKE |
|---|---|---|---|
| **0a** | NO FLASHOUT CODE BUT RABS LIGHT IS ILLUMINATED | | |
| • There are some faults that illuminate the REAR ANTILOCK light but will not provide a Flashout Code. Refer to Obtaining the Flashout Code in this Section for procedure. Also, be sure to make a good, momentary ground from the diagnostic lead. | | No Flashout Code ▶ | GO to Test **D2**. |

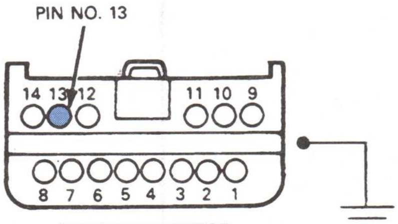
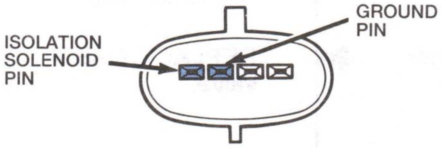
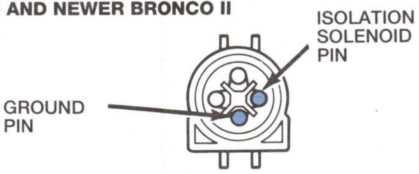
# Yellow REAR ANTILOCK Light Flashes 1 Time This Code Should Not Occur

**Flashout Code 1**

| TEST STEP | | RESULT ▶ | ACTION TO TAKE |
|---|---|---|---|
| **1a** | NO TEST | | |
| | • This code should not occur. Refer to Obtaining the Flashout Code in this Section for procedures involved in getting the code. | Flashout Code is 1 ▶ | If after repeated attempts to take the Flashout Code, Code 1 is still obtained GO to Test **E**. |

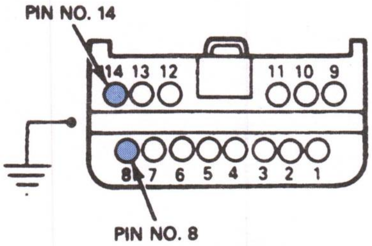
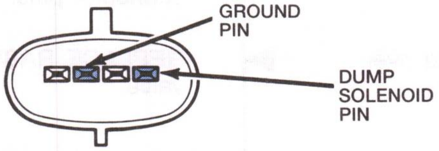
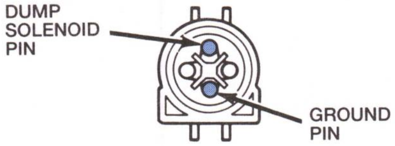
## Yellow REAR ANTILOCK Light Flashes 2 Times (Open Isolate Circuit)

**Flashout Code 2**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **2a** CHECK FOR OPEN RABS VALVE ISOLATION SOLENOID WIRING OR MODULE | | |
| 1. Turn ignition switch to the OFF position.<br>2. Disconnect battery.<br>3. Set the ohmmeter to the 200 ohm scale.<br>4. Disconnect module harness connector from module.<br>5. Check for resistance between harness connector Pin 13 and chassis ground. | Resistance less than 6 ohms ▶ | REPLACE RABS module. |
| | Resistance over 6 ohms ▶ | GO to **2b**. |
|  <br>**MODULE HARNESS CONNECTOR — PIN VIEW** | | |
| **2b** CHECK FOR OPEN RABS VALVE ISOLATION SOLENOID OR WIRING | | |
| 1. Disconnect battery.<br>2. Set ohmmeter to 200 ohm scale.<br>3. Check resistance between valve connector isolation solenoid pin and connector ground pin. | Resistance less than 6 ohms ▶ | REPAIR open in 599 circuit, isolation solenoid wire from valve to computer module. CHECK for dirty, loose or bent connector pins. |
|  <br>**RANGER, EXPLORER, AEROSTAR, 1989 AND NEWER BRONCO II** | Resistance over 6 ohms ▶ | REPLACE RABS valve. |
|  <br>**F-SERIES, E-SERIES, PRE-1989 BRONCO II, BRONCO** | | |

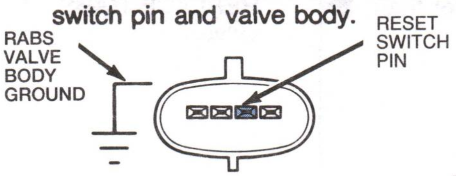
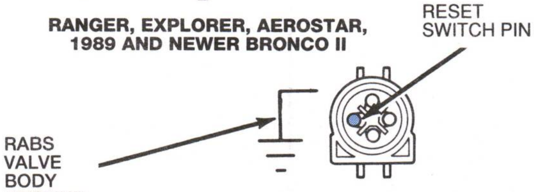
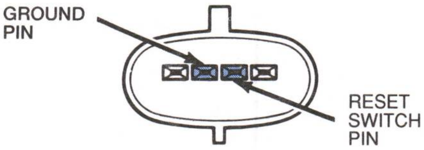
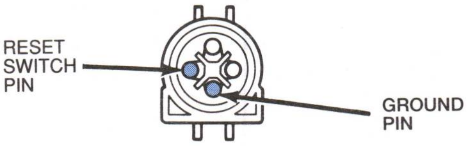
## Yellow REAR ANTILOCK Light Flashes 3 Times (Open Dump Circuit)

**Flashout Code 3**

| TEST STEP | RESULT | ACTION TO TAKE |
|---|---|---|
| **3a** CHECK FOR OPEN RABS VALVE DUMP SOLENOID WIRING OR COMPUTER MODULE | | |
| 1. Turn ignition switch to the off position.<br>2. Disconnect the battery.<br>3. Disconnect module harness connector from module.<br>4. Place the ohmmeter on the 200 ohm scale.<br>5. Check resistance between pin 8 (or pin 14) and chassis ground.<br><br> PIN NO. 14<br>14 13 12<br>11 10 9<br>8 7 6 5 4 3 2 1<br>PIN NO. 8<br>**MODULE HARNESS CONNECTOR — PIN VIEW** | Resistance less than 3 ohms | REPLACE computer module. |
| | Resistance greater than 3 ohms | GO to Test **3b**. |
| **3b** CHECK FOR OPEN RABS VALVE DUMP SOLENOID OR WIRING | | |
| 1. Turn the ignition switch to the off position.<br>2. Disconnect the battery.<br>3. Disconnect RABS valve harness connector from valve connector.<br>4. Check resistance between valve connector dump solenoid pin and ground pin.<br><br> <br>**RANGER, EXPLORER, AEROSTAR, 1989 AND NEWER BRONCO II**<br><br> <br>**F-SERIES, E-SERIES, PRE-1989 BRONCO II, BRONCO** | Resistance less than 3 ohms | REPAIR open in 664 circuit, dump solenoid wire, from valve to module. CHECK for loose, dirty or bent connector pins. |
| | Resistance greater than 3 ohms | REPLACE RABS valve. |

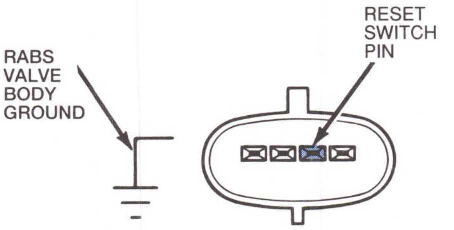
## Yellow REAR ANTILOCK Light Flashes 4 Times
## Red Brake Warning Light Illuminated
## RABS Valve Switch/Wiring or Open Dump Valve

**Flashout Code 4**

<table>
<tr><th colspan="2">TEST STEP</th><th>RESULT ▶</th><th>ACTION TO TAKE</th></tr>
<tr><td><b>4a</b></td><td>CHECK FOR CLOSED RABS VALVE SWITCH</td><td></td><td></td></tr>
<tr><td colspan="2">
1. Disconnect RABS valve harness connector from valve connector.<br>
2. Place ohmmeter on the 20K scale.<br>
3. Check resistance between valve connector switch pin and valve body.<br>

<br>
RANGER, EXPLORER, AEROSTAR, 1989 AND NEWER BRONCO II<br>

<br>
F-SERIES, E-SERIES, PRE-1989 BRONCO II, BRONCO
</td><td>Resistance greater than 10K ohms ▶<br>Resistance less than 10K ohms ▶</td><td>GO to Test <b>4B</b>.<br>REPLACE RABS valve.</td></tr>
<tr><td><b>4b</b></td><td>CHECK RESISTANCE BETWEEN VALVE SWITCH AND VALVE GROUND</td><td></td><td></td></tr>
<tr><td colspan="2">
1. Set the ohmmeter on the 20K ohm scale.<br>
2. Check resistance between valve connector switch pin and valve solenoid ground pin.<br>

<br>
RANGER, EXPLORER, AEROSTAR, 1989 AND NEWER BRONCO II<br>

<br>
F-SERIES, E-SERIES, PRE-1989 BRONCO II, BRONCO
</td><td>Resistance 18-26K ohms for aluminum valve, greater than 10K ohms for cast iron valve ▶<br>Resistance higher than 26K or lower than 18K for aluminum valve, less than 10K ohms for cast iron valve ▶</td><td>GO to Test <b>4C</b>.<br>REPLACE RABS valve.</td></tr>
</table>

## Yellow REAR ANTILOCK Light Flashes 4 Times
## Red Brake Warning Light Illuminated
## RABS Valve Switch, Wiring or Open Dump (Continued)

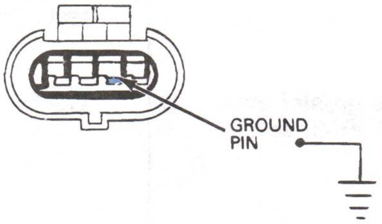
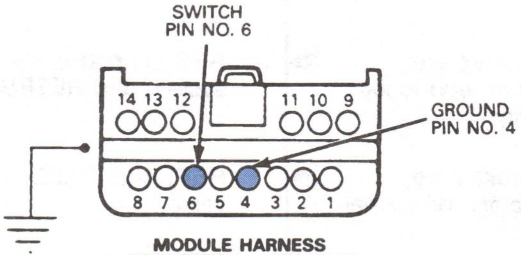
**Flashout Code 4**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **4c** CHECK FOR HYDRAULIC LEAK IN DUMP SECTION OF VALVE | | |
| 1. Set the ohmmeter on the 200K scale.<br>2. Check resistance between valve connector switch pin and valve body with hydraulic pressure applied for at least 30 seconds. | Resistance greater than 10K ohms ▶ | GO to Test **4d**. |
|  | Resistance lower than 10K ohms ▶ | REPLACE RABS valve. |

RANGER, EXPLORER, AEROSTAR, 1989 AND NEWER BRONCO II

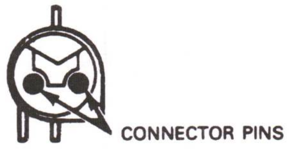
## Yellow REAR ANTILOCK Light Flashes 4 Times
## Red Brake Warning Light Illuminated
## RABS Valve Switch or Wiring (Continued)

**Flashout Code 4**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **4d** CHECK FOR OPEN RABS VALVE GROUND WIRE | | |
| 1. Set ohmmeter on 200 ohm scale.<br>2. Check for resistance between ground pin of harness connector and chassis ground. | Resistance less than 1 ohm ▶ | GO to Test **4e**. |
| | Resistance 1 ohm or more ▶ | REPAIR open in 397 circuit, isolation solenoid wire. CHECK for dirty or loose connector pins. |
|  <br>RABS VALVE HARNESS CONNECTOR — PIN VIEW | | |
| **4e** CHECK RESISTANCE IN RABS VALVE WIRING FROM THE MODULE CONNECTOR TO VALVE (OR MODULE) | | |
| 1. Install RABS valve connector into valve.<br>2. Disconnect battery<br>3. Disconnect the module harness connector from the module.<br>4. Set the ohmmeter on 200K scale.<br>5. Check resistance between pin 4 and pin 6 of module harness connector. | Resistance 18-26K ohms for aluminum valve, greater than 100K ohms for cast iron valve ▶ | REPLACE computer module. |
| | Resistance higher than 26K or lower than 18K for aluminum valve, less than 100K ohms for cast iron valve ▶ | REPAIR open or short in 535 circuit, valve switch wire from valve to computer module. |
|  SWITCH PIN NO. 6<br>GROUND PIN NO. 4<br>14 13 12<br>11 10 9<br>8 7 6 5 4 3 2 1<br>MODULE HARNESS CONNECTOR — PIN VIEW | | |

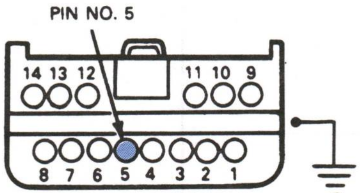
**Yellow REAR ANTILOCK Light Flashes 5 Times**
**System Dumps Too Many Times in 2WD (2WD and 4WD Vehicles) Condition Occurs While Making Normal or Hard Stops. Rear Brakes May Lock**

**Flashout Code 5**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **5a** CHECK FOR ERRATIC SENSOR SIGNAL | | |
| 1. Locate the sensor test connector.<br>2. Position vehicle on a hoist and raise the rear wheels to clear the floor.<br>3. Start the engine and turn the wheels at 5 mph.<br>4. Place voltmeter on the 2000 mV AC scale.<br>5. Measure voltage at the two pins of the sensor test connector. | | REPLACE module. |
| | Voltage less than 650 mV RMS or erratic ▶ | REPLACE sensor and recheck output and replace the sensor test connector cap. |
|  **SENSOR TEST CONNECTOR — PIN VIEW** | Voltage greater than 650 mV RMS and steady ▶ | GO to **5b.** |
| **5b** | | |
| For 4x2 vehicles or 4x4 vehicles for which the problem was initiated in 4x2 mode | | GO to Step **5c.** |
| For 4x4 vehicles for which the problem was initiated in 4x4 mode only | | GO to Step **5d.** |
| **5c** CHECK FOR MECHANICAL PROBLEMS IN REAR BRAKE SYSTEM | | |
| 1. Disconnect the RABS module harness connector from the module to deactivate the RABS.<br>2. Drive the vehicle (in 4x2 mode).<br>3. Make normal stops in a safe area to determine the condition of the rear brake system. | Rear brakes are grabby or tend to lock up easily ▶ | REPAIR rear brake system and RETEST. |
| | Rear brakes are satisfactory for normal braking ▶ | REPLACE RABS valve. |

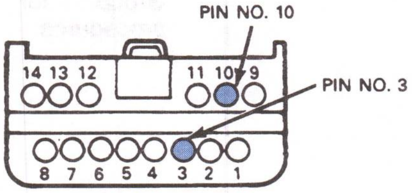
## Yellow REAR ANTILOCK Light Flashes 5 Times System Dumps Too Many Times in 2WD (2WD and 4WD Vehicles) Condition Occurs While Making Normal or Hard Stops. Rear Brakes May Lock (Continued)

**Flashout Code 5**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **5d** CHECK FOR MISSING SIGNAL FROM 4 WD SWITCH TO COMPUTER MODULE | | |
| 1. Disconnect the RABS module harness from the module.<br>2. Turn ignition switch on.<br>3. Shift into 4x4 mode.<br>4. Set voltmeter to 20 VDC scale.<br>5. Measure voltage between pin 5 and chassis ground.<br> <br>MODULE HARNESS CONNECTOR – PIN VIEW | Voltage is less than 1 volt ▶ | REPLACE RABS valve. |
| | Voltage is greater than 1 volt ▶ | REPAIR 4x4 indicator switch. REFER to the appropriate section in Group 07 for procedures. |

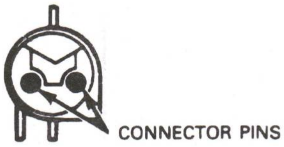
## Yellow REAR ANTILOCK Light Flashes 6 Times (Sensor Signal Rapidly Cuts In and Out) Condition Only Occurs While Driving

**Flashout Code 6**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **6a** CHECK FOR ERRATIC SENSOR SIGNAL AND LOOSE WIRE CONNECTIONS | | |
| 1. Turn ignition off.<br>2. Disconnect battery.<br>3. Set ohmmeter on the 2000 ohm scale.<br>4. Check resistance between Pin 10 and Pin 3 of the harness connector while shaking the harness from sensor to module.<br> PIN NO. 10<br>PIN NO. 3<br>14 13 12<br>11 10 9<br>8 7 6 5 4 3 2 1<br>MODULE HARNESS CONNECTOR – PIN VIEW | Constant reading of 1000 to 2000 ohms ▶ | GO to Step **6b**. |
| | Reading is erratic ▶ | REPAIR loose connection in the 519 or 523 circuits (sensor leads). CHECK for dirty or loose pins, frayed or shorted connectors. |
| **6b** CHECK FOR METAL CHIPS ON SENSOR MAGNET POLE PIECE | | |
| • Remove the sensor from the differential and inspect for a build-up of metal chips on sensor magnetic pole. | No metal chips are present ▶ | GO to Step **6c**. |
| | Metal chips are present ▶ | DRAIN and CLEAN differential. CHECK the excitor ring for broken or chipped teeth. |
| **6c** CHECK FOR EXCITOR RING DAMAGE | | |
| 1. Remove sensor from carrier.<br>2. Rotate excitor ring and check for damage to teeth. | Teeth are intact and no visible lateral runout is observed ▶ | REINSTALL sensor and GO to Test **6d**. |
| | Teeth are damaged or lateral runout of excitor ring is visible ▶ | REPAIR axle. REFER to the appropriate section in Group 15 for procedure. |

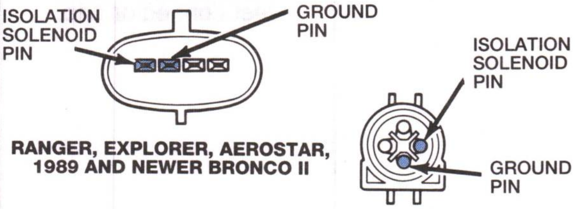
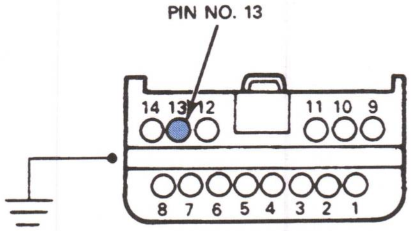
## Yellow REAR ANTILOCK Light Flashes 6 Times (Sensor Signal Rapidly Cuts In and Out) Condition Only Occurs While Driving (Cont'd)

**Flashout Code 6**

| TEST STEP | | RESULT ▶ | ACTION TO TAKE |
|---|---|---|---|
| **6d** | CHECK FOR ERRATIC OR LOW SENSOR OUTPUT ON COMPUTER MODULE | | |
| | 1. Locate the sensor test connector.<br>2. Position vehicle on a hoist and raise the rear wheels to clear the floor.<br>3. Start the engine and turn the wheels at 5 mph.<br>4. Place voltmeter on the 2000 mV AC scale.<br>5. Measure voltage at the two pins of the sensor test connector.<br><br> <br>SENSOR TEST CONNECTOR — PIN VIEW | Voltage greater than 650 mV RMS and steady ▶ | REPLACE module. |
| | | Voltage less than 650 mV RMS or erratic ▶ | REPLACE sensor and recheck output and replace the sensor test connector cap. |

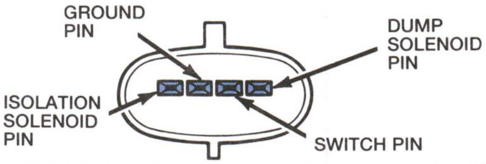
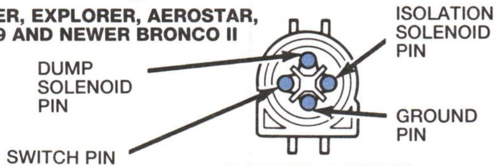
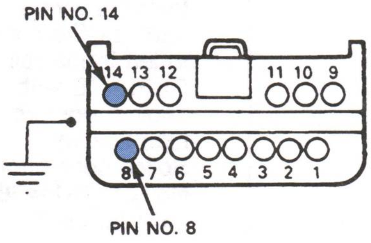
## Yellow REAR ANTILOCK Light Flashes 7 Times No Isolate Valve Self Test

**Flashout Code 7**

| TEST STEP | | RESULT ▶ | ACTION TO TAKE |
|---|---|---|---|
| **7a** | CHECK FOR RABS VALVE ISOLATION SOLENOID OR WIRING SHORTED TO GROUND | | |
| | 1. Turn ignition off.<br>2. Disconnect the valve harness connector from the valve connector.<br>3. Set the ohmmeter on the 200 ohm scale.<br>4. Measure the resistance between the valve isolation solenoid pin and the valve ground pin in the valve connector.<br><br> ISOLATION SOLENOID PIN<br>GROUND PIN<br>ISOLATION SOLENOID PIN<br>GROUND PIN<br>**RANGER, EXPLORER, AEROSTAR, 1989 AND NEWER BRONCO II**<br>**F-SERIES, E-SERIES, PRE-1989 BRONCO II, BRONCO** | Resistance is greater than 3 ohms ▶ | GO to Test **7B**. |
| | | Resistance is less than 3 ohms ▶ | REPLACE RABS valve. |
| **7b** | CHECK FOR BLOWN INTERNAL FUSE IN THE MODULE | | |
| | 1. Turn ignition off.<br>2. Disconnect the battery.<br>3. Disconnect the valve harness connector from the valve.<br>4. Disconnect the module harness connector from the module.<br>5. Place the ohmmeter on the 20K ohm scale.<br>6. Measure the resistance between module harness connector pin 13 and chassis ground.<br><br> <br>**MODULE HARNESS CONNECTOR — PIN VIEW** | Resistance greater than 20K ohms ▶ | REPLACE module. |
| | | Resistance less than 20K ohms ▶ | REPAIR short in 49.5 circuit between RABS valve and module. RECONNECT module and valve. |

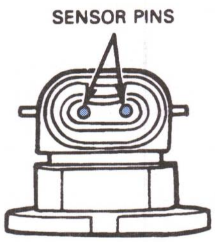
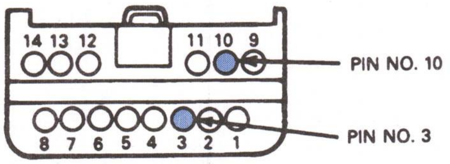
# Yellow REAR ANTILOCK Light Flashes 8 Times No Dump Valve Self Test

**Flashout Code 8**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **8a** CHECK FOR RABS VALVE SOLENOID OR WIRING SHORTED TO GROUND | | |
| 1. Turn ignition switch off.<br>2. Disconnect valve harness connector from valve connector.<br>3. Set the ohmmeter on the 200 ohm scale.<br>4. Measure the resistance between the valve dump solenoid pin and the valve ground pin in the valve connector.<br><br> GROUND PIN<br>DUMP SOLENOID PIN<br>ISOLATION SOLENOID PIN<br>SWITCH PIN<br>**RANGER, EXPLORER, AEROSTAR, 1989 AND NEWER BRONCO II**<br><br> ISOLATION SOLENOID PIN<br>DUMP SOLENOID PIN<br>GROUND PIN<br>SWITCH PIN<br>**F-SERIES, E-SERIES, PRE-1989 BRONCO II, BRONCO** | Resistance greater than 1 ohm ▶ | GO to Test **8b**. |
| | Resistance is less than 1 ohm ▶ | REPLACE RABS valve. |
| **8b** CHECK COMPUTER MODULE | | |
| 1. Turn ignition off.<br>2. Disconnect battery.<br>3. Disconnect valve harness connector from valve connector.<br>4. Disconnect the module harness connector from the module.<br>5. Set the ohmmeter on the 20K ohm scale.<br>6. Measure the resistance between module harness connector pin 8 (or pin 14) and chassis ground.<br><br> PIN NO. 14<br>14 13 12<br>11 10 9<br>8 7 6 5 4 3 2 1<br>PIN NO. 8<br>**MODULE HARNESS CONNECTOR — PIN VIEW** | Resistance greater than 20K ohm ▶ | REPLACE module. |
| | Resistance less than 20K ohm ▶ | REPAIR short in 664 circuit between RABS valve and RABS module. RECONNECT module and valve. |

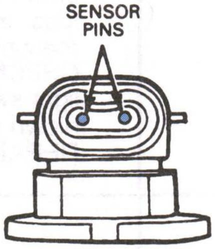
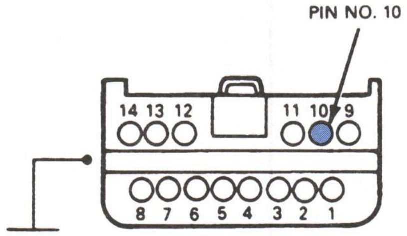
# Yellow REAR ANTILOCK Light Flashes 9 Times High Sensor Resistance

**Flashout Code 9**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **9a** CHECK FOR OPEN SENSOR OR SENSOR WIRING | | |
| 1. Turn key off.<br>2. Disconnect sensor harness connector from the sensor on the differential.<br>3. Set the ohmmeter on the 20K ohm scale.<br>4. Measure the resistance at the two sensor pins.<br><br> <br>**SENSOR — PIN VIEW** | Resistance less than 2500 ohms ▶ | GO to Test **9b**. |
| | Resistance greater than 2500 ohms ▶ | REPLACE sensor. |
| **9b** CHECK FOR OPEN SENSOR HARNESS WIRING | | |
| 1. Turn key off.<br>2. Disconnect battery.<br>3. Reconnect sensor harness connector to sensor.<br>4. Disconnect module harness connector from module.<br>5. Set the ohmmeter on the 20K ohm scale.<br>6. Measure the resistance between harness connector pins 3 and 10.<br><br> 14 13 12<br>11 10 9<br>8 7 6 5 4 3 2 1<br>PIN NO. 10<br>PIN NO. 3<br>**MODULE HARNESS CONNECTOR — PIN VIEW** | Resistance less than 2500 ohms ▶ | REPLACE module. |
| | Resistance greater than 2500 ohms ▶ | REPAIR open in circuits 519 or 523, sensor wires between the sensor and module. CHECK for loose or dirty pin connectors. If defect is found in wiring harness (from sensor to left frame rail), REPLACE with original equipment high flex wire. Splice connector No. E6EB-14488-AA must be used. |

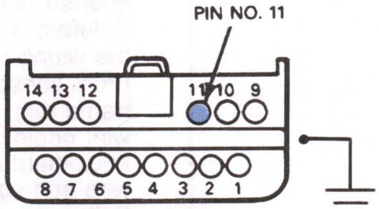
## Yellow REAR ANTILOCK Light Flashes 10 Times
## Low Sensor Resistance

**Flashout Code 10**

| TEST STEP | RESULT | ACTION TO TAKE |
|---|---|---|
| **10a** CHECK FOR SHORTED SENSOR<br>1. Turn ignition off.<br>2. Disconnect the sensor harness from the sensor.<br>3. Place the ohmmeter on the 20K ohm scale.<br>4. Measure the resistance at the two sensor pins.<br> <br>SENSOR — PIN VIEW | Resistance less than 1000 ohms ▶ | REPLACE sensor. |
| | Resistance is greater than 1000 ohms ▶ | GO to Test **10b**. |
| **10b** CHECKING FOR GROUNDED SENSOR WIRING<br>1. Turn ignition off.<br>2. Disconnect the battery.<br>3. Disconnect the sensor harness connector from the sensor.<br>4. Disconnect the module harness connector from the module.<br>5. Set the ohmmeter on the 20K ohm scale.<br>6. Measure the resistance from pin 10 of the harness connector to chassis ground.<br> <br>MODULE HARNESS CONNECTOR — PIN VIEW | Resistance less than 20K ohms ▶ | REPAIR short to ground in 523 circuit, sensor HI lead to module. CHECK for frayed wires or shorted connectors. If defect is found in the wiring harness (from sensor to left frame rail), REPLACE with original equipment high flex wire and splice using Splice Connector No. E6EB-14488-AA. |
| | Resistance is greater than 20K ohms ▶ | GO to Test **10c**. |

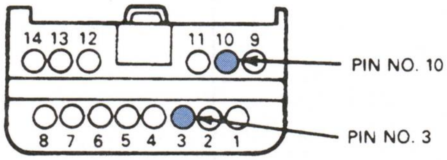
## Yellow REAR ANTILOCK Light Flashes 11 Times. Stoplamp Switch Always Closed or Stoplamp Switch Circuit Defective. Condition Indicated Only When Driving Above 35 mph.

**Flashout Code 11**

| TEST STEP | RESULT | ACTION TO TAKE |
|---|---|---|
| **11a** CHECK VEHICLE STOP LIGHTS | | |
| • Apply the service brakes and observe the rear brake lamps. | Lamps illuminate ▶ | GO to Test **11b**. |
| | Lamps do not illuminate ▶ | REPAIR or REPLACE vehicle stop light switch. CHECK for blown stop light switch fuse. Investigate reason for blown fuse. CHECK for open stop light switch wiring or blown stoplamps. REPAIR as needed. |
| **11b** WIRING FROM MODULE TO BRAKE SWITCH | | |
| • Check for an open between the brake switch and the module:<br>1. Turn the ignition off.<br>2. Set the voltmeter on the 20 VDC scale.<br>3. Remove the module harness connector.<br>4. Measure the voltage between pin 11 and chassis ground while stepping on the brake pedal.<br> <br>MODULE HARNESS CONNECTOR-PIN VIEW | Voltage is less than 9V ▶ | REPAIR the open in the 511 circuit. |
| | Voltage is 9V or more ▶ | CHECK 4 way flasher and directional wiring. This condition could create feedback through the stop light circuit. Also, cruise controls may not operate correctly. |

# Yellow REAR ANTILOCK Light Flashes 10 Times
# Low Sensor Resistance (Cont'd)

**Flashout Code 10**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **10c** CHECK FOR SHORTED SENSOR WIRING | | |
| 1. Turn ignition off.<br>2. Disconnect sensor harness connector from the sensor.<br>3. Disconnect the module harness connector from the module.<br>4. Place the ohmmeter on the 20K ohm scale.<br>5. Measure the resistance from pin 3 to pin 10 of the harness connector. | Resistance less than 20K ohms ▶ | REPAIR short between the 523 and 519 sensor circuits. CHECK for frayed wires or shorted connectors. If defect is found in the wiring harness (from sensor to left frame rail), REPLACE with original equipment high flex wire and SPLICE using Splice Connector No. E6EB-14488-AA. |
|   14 13 12<br>11 10 9<br>PIN NO. 10<br>PIN NO. 3<br>8 7 6 5 4 3 2 1 MODULE HARNESS CONNECTOR — PIN VIEW | Resistance greater than 20K ohms ▶ | REPLACE the RABS module. |

## Yellow REAR ANTILOCK Light Flashes 12 Times, Red Brake WARNING LIGHT Illuminated, Loss of Hydraulic Brake Fluid for One Second During Antilock Stop

**Flashout Code 12**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **12a** | | |
| Code 12 is not used. | | |

# Yellow REAR ANTILOCK Light Flashes 13 Times
# Speed Processor Check

**Flashout Code 13**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **13a** NO TEST | | |
| • RABS module speed circuit phase lock loop failure detected during module self test. | 13 flashes are present ▶ | REPLACE RABS module. |

# Yellow REAR ANTILOCK Light Flashes 14 Times Program Check

**Flashout Code 14**

| TEST STEP | | RESULT ▶ | ACTION TO TAKE |
|---|---|---|---|
| **14a** | NO TEST | | |
| | • RABS module program check sum failure detected during self test. | If 14 flashes are present ▶ | REPLACE RABS module. |

## Yellow REAR ANTILOCK Light Flashes 15 Times
## Memory Failure

**Flashout Code 15**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **15a** NO TEST | | |
| • RABS module RAM failure detected during self test. | If 15 flashes are present ▶ | REPLACE RABS module. |

## Yellow REAR ANTILOCK Light Flashes 16 Times or More
## 16 or More Flashes Should Not Occur

**Flashout Code 16**

| TEST STEP | RESULT ▶ | ACTION TO TAKE |
|---|---|---|
| **16a** NO TEST | | |
| • This code should not occur. Refer to obtaining the Flashout Code in this Section for procedures involved in getting the code. | Flashout Code is 16 ▶ | If after repeated attempts to take the Flashout Code, Code 16 is still obtained, REPLACE RABS module. |

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JANUARY, 1991

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